MI/DEQ/SWQ-02/092

MICHIGAN WATER CHEMISTRY TREND MONITORING
2000 Report

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SECTION 1.0

HIGHLIGHTS

- The Michigan Water Chemistry Trend Monitoring Project (WCTMP) was initiated in 1998. Results obtained from tributary monitoring efforts undertaken between June 1998 and September 1999 are summarized in the February 2002 report (MI/DEQ/SWQ-02/025).

- The WCTMP was expanded and redesigned in 2000 to more fully address the 4 goals identified in the January 1997 report entitled, "A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters." These goals are:

    1. Assess the current status and condition of individual waters of the state and determine whether standards are being met;
    2. Measure temporal and spatial trends in the quality of Michigan's surface waters;
    3. Provide data to support the MDEQ water quality programs and evaluate their effectiveness; and
    4. Detect new and emerging water quality problems.

- Twenty-nine tributary watersheds were sampled in 2000. One sampling station was located at or near the mouth of the main stream of each watershed, and at a mid-reach location in selected key watersheds.

- Twelve of 29 stations were sampled intensively (6 times) during periods of high flow and base/low flow, with an emphasis on the former. The remaining 17 stations were sampled non-intensively (3 times) without respect to stream flow conditions.

- Contaminants of interest at all sites included nutrients; conventionals; base/neutral organics; methyl *tert*-butyl ether (MTBE); benzene, toluene, ethylbenzene and xylene (BTEX); and low level mercury, trace metals, and polychlorinated biphenyls (PCBs). Contaminants designated as water quality indicators for purposes of comprehensive data analysis included total phosphorus, chloride, suspended solids, mercury, chromium, copper, and lead; water quality indicators were sampled at all sampling events at all stations. Spatial trend analysis focused on these water quality indicators, as will future temporal trend analysis.

- Data analysis consisted of spatial comparisons and comparisons against Michigan Rule 57 water quality values. Insufficient sample sizes obtained at intensively monitored stations precluded the use of stream discharge normalization methods; all spatial comparison analyses used actual contaminant concentrations. An inadequately representative sampling period precluded use of the 2000 results for calculating estimated loading rates. Temporal trend analyses will be prepared in future years as additional data are collected.

- Total PCB concentrations were lowest overall at the Sturgeon River (Delta County) and highest at the River Rouge.

- Among intensively monitored stations, median total mercury concentrations were lowest at the Au Sable River, and highest at the Kalamazoo River.

- Among non-intensively monitored stations, median total mercury concentrations were lowest at the Manistee River, and highest at the Flint River.

- Among intensively monitored stations, median total phosphorus, chloride, and suspended solids concentrations were lowest at the Au Sable, Cheboygan, and Thunder Bay Rivers. The Clinton River showed the highest median concentrations of these contaminants.

- Among non-intensively monitored stations, median total phosphorus, chloride, and suspended solids concentrations were lowest overall at the Manistique River. The Flint, Tittabawassee, and Cass Rivers showed the highest median concentrations of these contaminants, respectively.

- All samples analyzed for base/neutral organics, MTBE, and BTEX met applicable Michigan Rule 57 water quality values.

- All samples analyzed for total chromium, copper, and lead met applicable Michigan Rule 57 water quality values.

- Of the 29 stations sampled for mercury, 4 (the Au Sable, Manistee, upper Muskegon, and Thunder Bay River stations) showed no exceedances. All mercury samples from 11 of 29 stations exceeded the Michigan Rule 57 water quality value for mercury. The lowest concentration of total Hg was found in a sample collected at the Au Sable River (0.08 ng/L), and the highest concentration was found in a sample collected at the River Rouge (15 ng/L).

- All samples analyzed for total PCB exceeded the applicable Michigan Rule 57 water quality value of 0.026 ng/L at all 29 stations. The lowest concentration of total PCB was found in the sample collected at the Sturgeon River (0.28 ng/L), and the highest concentration was found in the sample collected at the River Rouge (75 ng/L).

SECTION 2.0

INTRODUCTION

In June 1998, the Michigan Department of Environmental Quality-Surface Water Quality Division (MDEQ-SWQD) initiated its Water Chemistry Trend Monitoring Project (WCTMP) using part of a $500,000 appropriation by the state legislature to the MDEQ-SWQD. This project was a first step towards improving water quality monitoring in Michigan since funding reductions resulted in severely restricted monitoring capabilities. Past limitations in analytical quantification levels further restricted the effectiveness of the MDEQ-SWQD monitoring activities. Recent technological advances in affordable, low-concentration analytical techniques incorporated into the WCTMP have made it possible to assess Michigan's surface waters for bioaccumulative chemicals of concern (BCCs), such as mercury and PCBs, at environmentally relevant levels.

The WCTMP is an important component of the statewide surface water quality monitoring activities outlined in the January 1997 report prepared by the MDEQ-SWQD and the Land and Water Management Division entitled, "A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (Strategy). The WCTMP incorporates the goals of the Strategy, which are:

1. Assess the current status and condition of individual waters of the state and determine whether standards are being met;
2. Measure temporal and spatial trends in the quality of Michigan's surface waters;
3. Provide data to support the MDEQ water quality programs and evaluate their effectiveness; and
4. Detect new and emerging water quality problems.

As initiated in 1998, the WCTMP called for annual water chemistry monitoring at selected Michigan streams tributary to the Great Lakes, and at Great Lakes connecting waters, Saginaw Bay and Grand Traverse Bay. With the November 1998 passage of the Clean Michigan Initiative (CMI) bond proposal, a substantial increase in annual funding became available for statewide surface water quality monitoring beginning in 2000. The study design of the WCTMP was subsequently modified and expanded to help ensure implementation of statewide water chemistry trend monitoring activities capable of more fully realizing the goals set forth in the Strategy.

This report describes the expanded study design of that portion of the WCTMP which targeted tributary watersheds, and presents and discusses the results from monitoring efforts undertaken July through November 2000 within these watersheds. Details of the expanded WCTMP in its entirety are presented in Great Lakes and Environmental Assessment Section Procedure 58: Water Quality Monitoring (Appendix A, available upon request).

Results obtained from tributary monitoring efforts undertaken between June 1998 and September 1999 are summarized in the February 2002 WCTMP report (MI/DEQ/SWQ-02/025). Results obtained from monitoring efforts undertaken during the same period at Saginaw and Grand Traverse Bays are presented and discussed with previously unpublished results in the January 2001 report entitled, “Water Quality Monitoring of Saginaw Bay and Grand Traverse Bay” (MI/DEQ/SWQ-01/017). Results obtained at these bay stations in 2000 will be presented and discussed with previously published results in a report currently being written. Results

obtained from monitoring efforts undertaken between June 1998 and November 2000 on Great Lakes connecting waters will be presented and discussed with previously unpublished results in a report currently being written. These reports are, or will be, available upon request from the MDEQ-SWQD.

In accordance with one of the key principles of the Strategy, the WCTMP was planned and conducted in partnership with several outside organizations. In 2000, these included the United States Geological Survey (USGS), the Wisconsin State Laboratory of Hygiene (WSLH), and the Grand Traverse Band of Chippewa and Ottawa Indians. The WCTMP is coordinated by the MDEQ-SWQD.

SECTION 3.0

STUDY DESIGN AND METHODS

A total of 29 watersheds were monitored between July and November 2000 as part of the WCTMP. This report includes all analytical results from samples collected during this period.

3.1 WATERSHED SELECTION, STATION SELECTION, AND MONITORING SCHEDULES

During the process of enhancing the WCTMP, one primary objective was consistency with existing MDEQ programs and activities to ensure that monitoring would contribute to resource management decisions. This objective led to adapting the WCTMP to the basin year cycle defined and utilized by the National Pollutant Discharge Elimination System (NPDES) permitting program. Consistent with this cycle, the WCTMP recognizes 45 watershed units. Each watershed unit is based on drainage to 1 of the 4 Great Lakes and is allocated to 1 of 5 basin years. Figure 1 shows the watershed units allocated to basin year 4, which coincides with 2000. Figures 2 and 3 show the watershed units allocated to basin years 5, 1, 2, and 3, which coincide with 2001, 2002, 2003, and 2004, respectively.

Of the 45 watershed units recognized, 31 have been selected for placement of water chemistry monitoring stations within the WCTMP. The locations of these 31 monitoring stations were selected based on consideration of a number of criteria, including avoidance of stream reaches subject to flow reversals (although this objective was not achievable on the Saginaw River), surrounding land use, availability of historical water quality data, proximity to USGS stream flow gauging stations, and accessibility. These 31 monitoring stations have been categorized as either intensive sites or integrator sites. Integrator sites are further categorized as either intensively or non-intensively monitored; this categorization changes depending upon basin year. Watershed selection and monitoring schedules are described below.

3.1.1 Intensive Sites

Of the 31 watersheds selected for placement of monitoring stations, the following 6 have been designated for intensive sampling annually irrespective of basin year: Au Sable, Clinton, Lower Grand, Lower Kalamazoo, Lower Muskegon, and Saginaw River watersheds (Figure 4). The Saginaw River was not sampled in 2000 due to extensive sediment remediation scheduled to take place in that watershed. High flow volume and known or expected contamination were important watershed selection criteria in the intensive sites category, as these combined factors are associated with the most significant sources of contaminant loading to the Great Lakes. With the exception of the Saginaw River, watershed selection was also based on stability of the flow regime in the main stream, insofar as stable flows generally yield more precise contaminant loading estimates and more readily detectable contaminant concentration and loading trends with fewer samples. Monitoring stations were located at or near the mouth of the main stream within each watershed. Table 1 provides detailed station location information.

The expanded study design of the WCTMP calls for intensive sites to be sampled 12 times per year on a flow-stratified schedule during the period beginning with the first significant snowmelt

or spring rain event and continuing through autumn. Of these 12 samples, approximately 75% are to be collected at each site during high flow events and the remaining 25% are to be collected during base/low flow. A high flow event is defined by one or more of the following conditions: stream flow at or above the 20% exceedance flow; an increase in stream flow of approximately 100% above the preceding base flow condition; or an increase in stream flow following a lengthy period of discharge at base flow and considered likely to produce a measurable change in the concentration of sampled constituents. This monitoring schedule was adopted specifically for those contaminants for which loading rate estimates would be calculated, based on its application in the Lake Michigan Mass Balance Project (USEPA 1997a; USEPA 1997b); not all contaminants monitored at intensive sites are to be sampled on this schedule (see Section 3.2 of this report for details).

Funding approval delays prevented sampling from commencing until July 2000, resulting in fewer than 12 samples collected and a sampling period considered inadequately representative of the entire year.

3.1.2 Integrator Sites

The remaining 25 watersheds selected for placement of monitoring stations have been designated as integrator sites (Figure 5). Integrator sites represent water quality conditions of major streams and rivers in large, heterogeneous basins. Monitoring stations at integrator sites generally were located at or near the mouth of the main stream within each watershed. Four integrator sites represent the upper reaches of the largest watersheds. Specifically, this encompasses mid-reach monitoring stations located on the St. Joseph, Kalamazoo, Grand, and Muskegon Rivers. Table 1 provides detailed station location information.

The expanded study design of the WCTMP calls for integrator sites to be sampled intensively on a staggered 5-year rotation. Once every 5 years (consistent with the NPDES permitting program's basin year cycle), each integrator site is to be sampled 12 times on a flow-stratified schedule identical to that adopted for intensive sites. As with intensive sites, this schedule allows for calculation of estimated loading rates for selected contaminants. During the other 4 years in this 5-year cycle, the expanded study design of the WCTMP calls for integrator sites to be sampled 4 times per year. These sampling events are prearranged within the period between ice breakup and ice cover irrespective of stream flow. As with intensive sites, funding approval delays in 2000 prevented sampling from commencing until July of that year, resulting in fewer than 12 samples collected at intensively monitored integrator sites, and fewer than 4 samples collected at non-intensively monitored integrator sites.

3.2 SAMPLE COLLECTION AND CHEMICAL ANALYSES

Sample collection and chemical analyses are discussed below by analyte category. All participating analytical laboratories have quality assurance programs and use peer-reviewed analytical methods.

3.2.1 Nutrients and Conventionals, Base/Neutral Organics, MTBE, and BTEX

The nutrient and conventional parameters identified in Table 2 were measured at all stations during each sampling event. Table 2 also provides quantification levels where applicable. Field measurements of dissolved oxygen, temperature, pH, and conductivity were taken during each sampling event using a Hydrolab Surveyor II™ (Model SRV2) or a YSI™ water quality monitoring sonde (Model 600XL), unless equipment problems prevented this.

Samples for analysis of selected base/neutral organics, MTBE, and BTEX were added to the WCTMP in 1999 to support the Strategy's goal to detect new and emerging water quality problems. Because few 1999 samples analyzed for base/neutral organics, and none analyzed for MTBE or BTEX, contained concentrations above analytical quantification, sample collection for these analytes was reduced in 2000 to one sample per monitoring station during the base/low flow season. Base/neutral organics analyzed are identified in Table 3 along with analytical quantification levels. BTEX and MTBE are listed with analytical quantification levels in Table 4.

In most cases, grab samples were collected from a single point in the flow of the stream at approximately 0.3 – 1.0m depth. A subset of grab samples were collected using the method described for PCBs in Section 3.2.3. Samples were handled in accordance with standard MDEQ procedures (MDNR 1994), and were analyzed by the MDEQ Environmental Laboratory.

3.2.2 Total Mercury and Trace Metals

Samples for total mercury (Hg) and trace metals were collected at all stations during each sampling event, and were analyzed by the WSLH. All metals analyzed are shown in Table 5 with analytical detection and quantification levels. Sample collection and handling was carried out in accordance with USEPA Method 1669, "Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels" (USEPA 1996a). Samples were collected from a single point in the flow of the stream at approximately 0.3 – 1.0m depth.

Total Hg samples were analyzed by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry, consistent with USEPA Method 1631B (USEPA 1999). Samples were analyzed for the trace metals cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), nickel (Ni), and zinc (Zn) by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS), consistent with USEPA Method 1638 (USEPA 1996b).

3.2.3 Polychlorinated Biphenyls

The expanded study design of the WCTMP calls for total PCB sampling at all monitoring stations at a rate of at least one sample per station annually. This would allow for statewide spot checks of this contaminant, and it would enable limited spatial comparisons and comparisons with Michigan Rule 57 water quality values. Table 6 shows all PCB congeners analyzed, along with their analytical detection and quantification levels. In 1998-1999, a subset of samples analyzed for PCB was also analyzed for chlorinated organic pesticides. In 2000, these analyses were omitted from the WCTMP due to the higher priority given to statewide PCB

monitoring based on results obtained from PCB and chlorinated organic pesticide monitoring in 1998-1999.

The PCB samples were collected in accordance with the sample collection and handling protocol described in the "Lake Michigan Mass Balance Study Methods Compendium, Volume 1: Sample Collection Techniques" (USEPA 1997a). A 160L sample volume was obtained by drawing water from 2 depths (at 0.2 and 0.8 of the total stream depth) at each of 3 points in a transect (at 0.25, 0.5 and 0.75 of the stream channel width). The WSLH performed the chemical analyses in accordance with the analytical protocol described in the "Lake Michigan Mass Balance Study Methods Compendium, Volume 2: Organic and Mercury Sample Analysis Techniques" (USEPA 1997b), with the exception that dissolved and particulate fractions were combined.

3.3 SUMMARY STATISTICS

Summary statistics presented in this report include measures of central tendency, spatial comparisons, and comparisons with Michigan Rule 57 water quality values. A fourth category of summary statistic, that of contaminant loading rate estimates, is discussed; however, because the sampling period was inadequately representative of the entire year and because fewer than the requisite number of high flow samples were collected, contaminant loading rate estimates could not be calculated using 2000 data. A final category of summary statistic, that of temporal trend analysis, is also discussed; however due to the early stage of the WCTMP, temporal trend analyses are not yet possible.

Detecting trends in stream water quality is not a simple task. Relatively large changes in contaminant concentrations caused by both short- and long-term changes in stream discharge serve to obscure smaller, non-climatological trends (Harned et al. 1981). It is the goal of the MDEQ to control for the effects of stream discharge in the spatial and temporal trend analyses performed using WCTMP data. The statistical method selected to accomplish this is Locally Weighted Scatterplot Smoothing (LOWESS), (Helsel 1991). Sample sizes obtained in 2000 were not large enough to support the use of this statistical method. For this reason, spatial comparisons presented in this report were made using actual, as opposed to normalized, contaminant concentrations. Temporal trend analyses presented in future WCTMP reports will be prepared from concentrations normalized to stream discharge using LOWESS.

3.3.1 Handling of Coded and Censored Data

Coded data, censored data, and data below analytical quantification or detection levels, and the handling of these in the development of summary statistics, are discussed by analyte category, below. Table 7 provides a comprehensive list of laboratory result remark codes used in this report, along with their definitions.

3.3.1.1 Nutrients and Conventionals, Base/Neutral Organics, MTBE, and BTEX

In many cases, the MDEQ Environmental Laboratory censors (does not report) observed concentrations below analytical quantification. Often in such cases, the laboratory reports either the analyte's quantification level coded with a K, or (as with base/neutral organics, MTBE and

BTEX), it reports only ND. In other cases, however, the laboratory reports the "lowest normally reportable value," coded with a W. Lowest normally reportable values represent the lowest concentration that the analytical device can read, rounded to the appropriate number of significant figures. In cases where the laboratory does report observed concentrations below quantification, such results are reported with a T code.

It is impossible to calculate the true average of a data set containing censored data. In such cases, average concentrations were calculated using half the quantification level in place of censored values. Calculated averages were then footnoted to indicate that estimated values had been used. Estimated values were likewise used in spatial comparisons developed for this report and will be used in future calculations of estimated contaminant loading rates, and in temporal trend analyses. Results coded with a T or W were used in all calculations.

Occasionally, due to travel distances and day or time of sample collection, field staff were unable to deliver samples to the laboratory in time to meet the recommended maximum holding times before analysis for certain analytes; the analytical results for such samples are coded HT by the laboratory. Results coded HT are considered sufficiently reliable for use in the development of all summary statistics prepared for the WCTMP (MDEQ 1999).

3.3.1.2 Total Mercury and Trace Metals

Total Hg and trace metal concentrations below analytical quantification or detection levels were reported and were used in all calculations, as were all coded results. Sample results below the WSLH's daily instrument calibration blank were reported as zero by the WSLH, and these zero values were used in all calculations.

3.3.1.3 Polychlorinated Biphenyls

Total PCB concentrations were estimated by summing the concentrations of the individual and coeluting congeners identified in Table 6. Congener concentrations below analytical quantification or detection levels were reported and were used in calculating total PCB. Congener concentrations not detected above noise were reported as zero by the WSLH, and zero values were used for the purpose of calculating total concentrations. If the concentrations of all congeners in a sample were reported as zero, then total PCB was reported as zero. In samples where the presence of uncontrollable interference made analysis impossible, the WSLH reported NAI in place of a result. Such congeners were assigned a concentration equal to zero for the purpose of calculating total PCB concentrations. If all congeners in a given sample were coded NAI, then total PCB for that sample was reported as NAI, and that sample was not counted in developing summary statistics. In some cases, sample dilution was necessary to bring analyte concentration ranges within the instrument calibration range. Occasionally as a result of dilution, congeners already present in low concentrations could not be detected after dilution. In such cases, the WSLH reported NDD in place of a result. Such congeners were assigned a concentration equal to zero for the purpose of calculating total concentrations.

3.3.2 Measures of Central Tendency

Where possible, average and median concentrations were calculated for each analyte at each monitoring station.

3.3.3 Spatial Comparisons

Box plot graphs were developed showing concentrations of total phosphorus, chloride, suspended solids (TSS), Hg, trace metals, and PCB within each watershed. Comparisons were made among watersheds sampled at the same frequency (i.e., intensively or non-intensively). Box plots were ranked lowest to highest according to median actual contaminant concentration. Where necessary to render differences among data groups more readily discernible, data were logarithmically transformed.

The WCTMP did not use a randomized sampling design. For this reason, its ability to yield spatial comparison information is restricted to those sites that were actually sampled; the sampling design of the WCTMP does not support extrapolation of the data to sites that were not sampled. The feasibility and value of incorporating a randomized sampling design component into future implementations of the WCTMP are currently being evaluated. Due to the relatively small size of the data sets at this stage of the WCTMP, tests for statistical significance would not yield meaningful results and therefore no such tests were made. The statistical significance of differences among watersheds will be tested when the data sets become large enough to support such determinations.

3.3.4 Loading Rate Estimates

Loading rate estimates were not calculated from 2000 data due to a non-representative sampling period in that year. The study design of the WCTMP calls for loading rate estimates to be calculated from designated water quality indicators measured at intensively monitored sites. The approach selected for making these calculations is the Stratified Beale Ratio Estimator, described by Richards (1994).

3.3.5 Comparisons Against Michigan Rule 57 Water Quality Values

Data obtained for all designated water quality indicators, as well as data obtained for total PCB, base/neutral organics, MTBE and BTEX, were compared against applicable Rule 57 water quality values. These values were developed in accordance with the Part 4 Michigan Water Quality Standards promulgated pursuant to Part 31 of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended.

For Hg, the applicable Rule 57 water quality value is the wildlife value (WV); for Cr, Cu and Pb, the applicable Rule 57 water quality value is the final chronic value (FCV); and for total PCB, the applicable Rule 57 water quality value is the human cancer value (HCV). The FCV for Cr, Cu, and Pb is hardness dependent and was calculated for each tributary watershed using tributary-specific hardness data. Ambient Cr, Cu, and Pb concentrations are for total metal, whereas the FCVs for these trace metals are expressed as dissolved metal. For this reason, a direct

comparison between ambient Cr, Cu, and Pb concentrations and Rule 57 water quality values cannot be made. This is not an important consideration when the ambient concentration meets the applicable Rule 57 water quality value; however, when it exceeds this value, the available data cannot show whether the ambient concentration of metal in the dissolved fraction exceeds the Rule 57 water quality value. Additional, more sophisticated monitoring would be necessary to resolve an ambiguity of this nature, and caution must be exercised when drawing conclusions from the available data.

For MTBE and BTEX, the lowest Rule 57 water quality value is the final chronic value (FCV). For base/neutral organics, the lowest Rule 57 water quality value differs among the 27 of 49 chemicals in this category for which these values have been developed; this will be addressed fully in Section 4.4.1. Base/neutral organics for which Rule 57 water quality values have been developed are listed in Table 3 (Groups 1 and 2).

3.3.6 Temporal Trend Analyses

Measurement of temporal trends is one of the key goals of the WCTMP; however, temporal trend analysis is not yet possible in this early stage of the WCTMP. These analyses will be prepared and presented in future WCTMP reports when a sufficient number of years of data are available to support them. The WCTMP will evaluate temporal trends in annual loading rates of all designated water quality indicators (i.e., total phosphorus, chloride, suspended solids, Hg, Cr, Cu, and Pb), consistent with existing federal and state guidelines on selecting water quality indicators. Loading rates used to evaluate temporal trends will be calculated with the Stratified Beale Ratio Estimator from contaminant concentrations normalized to stream discharge using LOWESS. Table 8 provides an alphabetized list of all existing WCTMP monitoring stations, along with year(s) sampled.

SECTION 4.0

RESULTS, SUMMARY STATISTICS, AND DISCUSSION

Field staff collected a total of 123 water samples between July and November 2000.

4.1 MEASURES OF CENTRAL TENDENCY

Analytical results and measures of central tendency are presented for all analytes (Appendix B, available upon request).

4.2 SPATIAL COMPARISONS

Concentrations of all designated water quality indicators as well as total PCB were compared among monitoring stations. With the exception of PCB which was sampled once at each site, comparisons were made among monitoring stations that had been sampled at the same frequency (i.e., intensively or non-intensively). All graphs represent actual (as opposed to normalized) values, logarithmically transformed. Where censored values were present in a data set, estimated values were used in their place. In 2000, censored values were present only in data sets for TSS (Quantification Level = 4 mg/L).

4.2.1 Spatial Comparisons Among Intensively Monitored Sites

Monitoring for total phosphorus, chloride, TSS, Hg, Cr, Cu, Pb, and PCB took place at 12 intensively monitored sites, including intensive sites and intensively monitored integrator sites (Table 1). These sites were ranked lowest to highest according to median contaminant concentration, and the resulting graphs (Figures 6 - 12) are discussed below.

4.2.1.1 Total Phosphorus, Total Chloride and Total Suspended Solids

Total phosphorus, chloride, and TSS were sampled at all intensively monitored sites. The box plot graphs presented in Figures 6 - 8 show these sites ranked lowest to highest according to median contaminant concentration. Among intensively monitored sites, median total phosphorus (Figure 6) was lowest at the Au Sable and Cheboygan Rivers (0.01 mg/L); chloride (Figure 7) was lowest at the Au Sable River (5.5 mg/L); and TSS (Figure 8) was lowest at the Au Sable, Cheboygan, and Thunder Bay Rivers (< 4 mg/L). Median concentrations of all contaminants were highest at the Clinton River (total phosphorus = 0.16 mg/L; chloride = 97 mg/L; TSS = 35.5 mg/L).

4.2.1.2 Total Mercury and Trace Metals

Total Hg, Cr, Cu, and Pb were sampled at all intensively monitored sites. The box plot graphs presented in Figures 9 - 12 show these sites ranked lowest to highest according to median

contaminant concentration. Among intensively monitored sites, the Au Sable River ranked lowest in all contaminants (median Hg = 0.17 ng/L; Cr = 0.075 ug/L; Cu = 0.23 ug/L; Pb = 0.029 ug/L). In contrast with low rankings, high rankings were more variable. Median total Hg (Figure 9) was highest at the lower Kalamazoo River (6.2 ng/L); Cr and Pb (Figures 10 and 12) were highest at the River Rouge (2.2 ug/L and 2.6 ug/L, respectively); and Cu (Figure 11) was highest at the Clinton River (4.7 ug/L).

4.2.2 Spatial Comparisons Among Non-Intensively Monitored Sites

Monitoring for total phosphorus, chloride, TSS, Hg, Cr, Cu, Pb, and PCB took place at 17 non-intensively monitored sites (Table 1). These sites were ranked lowest to highest according to median contaminant concentration, and the resulting graphs (Figures 13 - 19) are discussed below.

4.2.2.1 Total Phosphorus, Total Chloride, and Total Suspended Solids

Total phosphorus, chloride, and TSS were sampled at all non-intensively monitored sites. The box plot graphs presented in Figures 13 - 15 show these sites ranked lowest to highest according to median contaminant concentration. Among non-intensively monitored sites, median total phosphorus (Figure 13) was lowest at the Manistee and Manistique Rivers (0.02 mg/L); chloride (Figure 14) was lowest at the Manistique, Pine, and Tahquamenon Rivers (2.0 mg/L); and TSS (Figure 15) was lowest at the Manistique and Tahquamenon Rivers (< 4 mg/L). Median total phosphorus was highest at the Flint River (0.15 mg/L); chloride was highest at the Tittabawassee River (52 mg/L); and TSS was highest at the Cass River (40 mg/L).

4.2.2.2 Total Mercury and Trace Metals

Total Hg, Cr, Cu, and Pb were sampled at all non-intensively monitored sites. The box plot graphs presented in Figures 16 - 19 show these sites ranked lowest to highest according to median contaminant concentration. Among non-intensively monitored sites, the Manistee River ranked lowest in total Hg and Cr (0.48 ng/L and 0.21 ug/L, respectively); the Manistique River ranked lowest in total Cu (0.31 ug/L); and the Tahquamenon River ranked lowest in total Pb (0.032 ug/L). Median total Hg (Figure 16) was highest at the Flint River (3.9 ng/L); Cr (Figure 17) was highest at the Pine River (1.5 ug/L); Cu (Figure 18) was highest at the River Raisin (3.1 ug/L); and Pb (Figure 19) was highest at the Huron River (2.05 ug/L).

4.2.3 Polychlorinated Biphenyls

Total PCB was sampled once at each station monitored in 2000. The graph presented in Figure 20 shows all stations ranked lowest to highest according to total PCB concentration. The lowest concentration of total PCB was found in the sample collected at the Sturgeon River (0.28 ng/L), and highest concentration was found in the sample collected at the River Rouge (75 ng/L).

4.3 LOADING RATE ESTIMATES

Loading rate estimates were not calculated for designated water quality indicators, due to a non-representative sampling period and an insufficient number of samples collected during high flow events in 2000. Hydrographs of stream discharge are shown for each monitoring station in the intensive and intensively monitored integrator site categories, with the exception of the Thunder Bay River for which stream discharge data were unavailable (Figures 21 - 31). The study design of the WCTMP calls for calculations of loading rate estimates for designated water quality indicators using the Stratified Beale Ratio Estimator (Richards 1994).

4.4 COMPARISONS AGAINST MICHIGAN RULE 57 WATER QUALITY VALUES

Individual sample concentrations and (for contaminants sampled multiple times at a single monitoring station) the calculated mean concentration of each analyte were compared against the applicable lowest non-drinking water Rule 57 water quality value based on chronic toxicity. Exceedance rate is represented by the number of individual samples in exceedance of the applicable Rule 57 water quality value / the total number of analyses completed for that contaminant at each monitoring station.

4.4.1 Base/Neutral Organics, MTBE and BTEX

Table 3 – Groups 1 and 2 identifies the base/neutral organics analyzed and for which Rule 57 water quality values have been developed, along with their analytical quantification levels and Rule 57 water quality values. Of the 29 samples analyzed for base/neutral organics in 2000, none contained concentrations above analytical quantification. Group 1 of Table 3 shows the 21 base/neutral organics with quantification levels below the applicable Rule 57 water quality value. Sample results for these contaminants definitely did not exceed Rule 57 water quality values. Group 2 of Table 3 shows the 4 base/neutral organics (carbazole, dibenzofuran, hexachlorobutadiene, and hexachlorocyclopentadiene) with quantification levels *above* the Rule 57 water quality value. A definitive comparison against Rule 57 water quality values cannot be made for these contaminants using the data obtained.

Table 4 lists MTBE and BTEX with their quantification levels and Rule 57 water quality values. All MTBE samples were below analytical quantification (QL = 5.0 ug/L); all MTBE samples were therefore well below the MTBE Rule 57 water quality value (FCV = 730 ug/L). Among the BTEX contaminants, only 1 toluene sample (collected at the Cheboygan River) contained concentrations above analytical quantification. This sample result (1.1 ug/L) was well below the Rule 57 water quality value for toluene (FCV = 140 ug/L). All other BTEX samples were below analytical quantification (QL range: 1.0 – 2.0 ug/L), and were therefore well below applicable Rule 57 water quality values (Rule 57 water quality value range: 18 – 200 ug/L).

4.4.2 Total Mercury and Trace Metals

Hg, Cr, Cu, and Pb concentrations are compared with applicable Rule 57 water quality values in Table 9. Also shown in this table are the mean and range of concentrations, and the exceedance rate for each contaminant.

No exceedances were found in any samples analyzed for total Cr, Cu, or Pb. All samples collected for total Hg at 4 of 29 monitoring stations met the Hg Rule 57 water quality value of 1.3 ng/L. This included 2 intensively monitored stations (the Au Sable and Thunder Bay Rivers), and 2 non-intensively monitored stations (the Manistee and upper Muskegon Rivers). At 4 of 12 intensively monitored sites, total Hg exceeded 1.3 ng/L in all samples collected. These sites are listed here with their range of Hg concentrations: Clinton River (1.5 – 12 ng/L), Escanaba River (2.07 – 3.3 ng/L), lower Grand River (1.4 – 7.7 ng/L), and lower Kalamazoo River (3.2 – 8.8 ng/L). At 7 of 17 non-intensively monitored sites, total Hg exceeded 1.3 ng/L in all samples collected. This included the Black River (1.4 – 3.1 ng/L), Cass River (1.8 – 2.8 ng/L), upper Kalamazoo River (2.4 – 7.2 ng/L), Menominee River (2.0 – 4.6 ng/L), Pine River (1.4 – 1.9 ng/L), River Raisin (1.4 – 5.7 ng/L), and lower St. Joseph River (2.2 – 3.4 ng/L). The remaining 14 monitoring stations showed at least 1 sample in exceedance of the Hg Rule 57 water quality value (see Table 9).

4.4.3 Polychlorinated Biphenyls

Total PCB concentrations measured at each monitoring station are shown in Table 10. Results showed that total PCB exceeded the PCB Rule 57 water quality value of 0.026 ng/L in all samples analyzed at all monitoring stations. The lowest concentration of total PCB was found in the sample collected at the Sturgeon River (0.28 ng/L), and the highest concentration was found in the sample collected at the River Rouge (75 ng/L).

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SECTION 5.0

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Figure 1. Year 2000 monitoring watersheds (Basin Year 4).

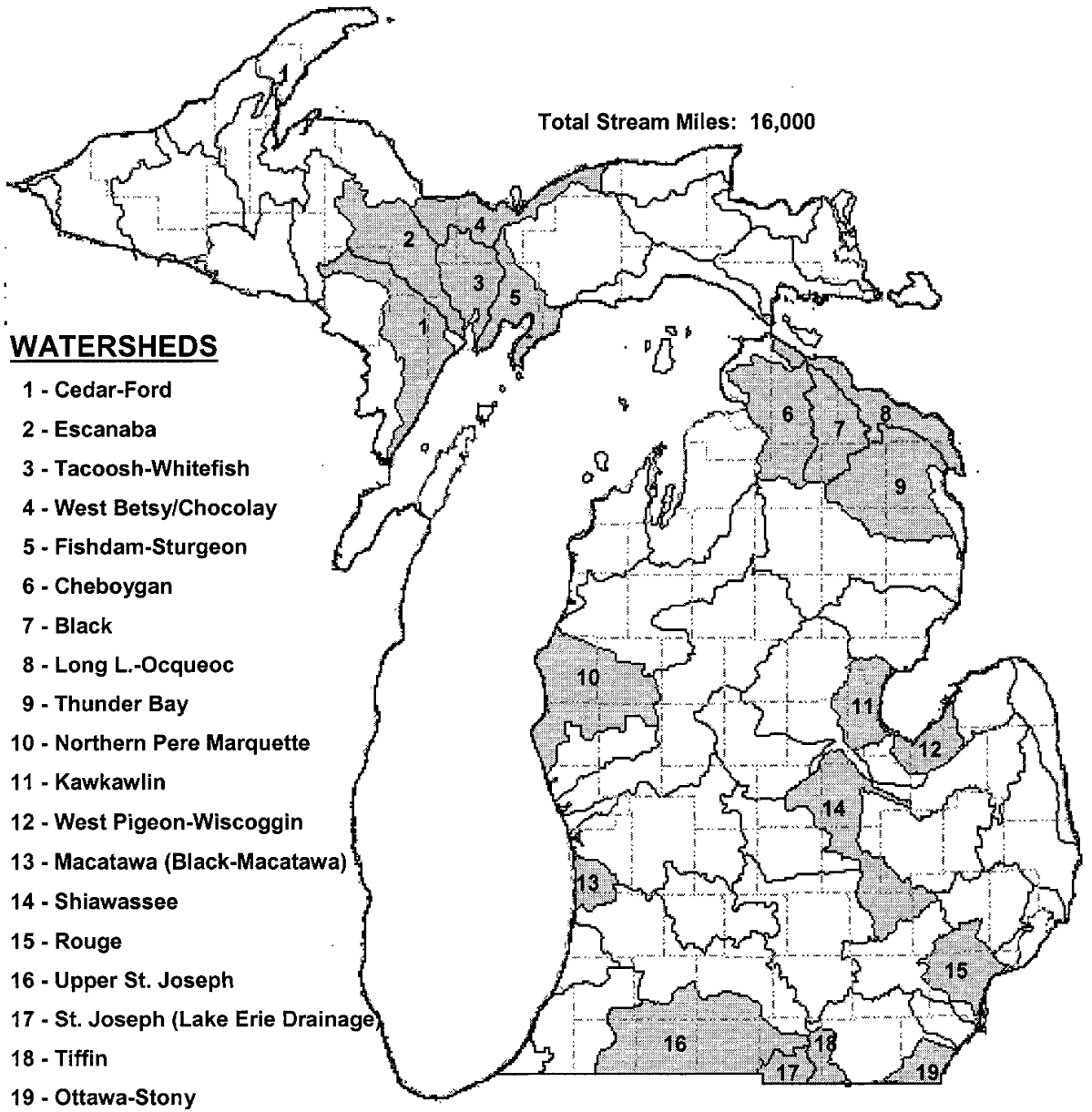

Figure 2. Year 2001 and Year 2002 monitoring watersheds.

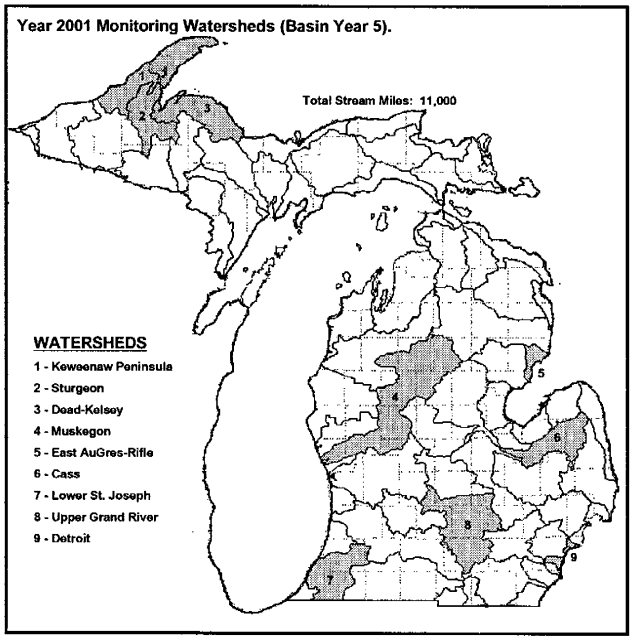

Figure 3. Year 2003 and Year 2004 monitoring watersheds.

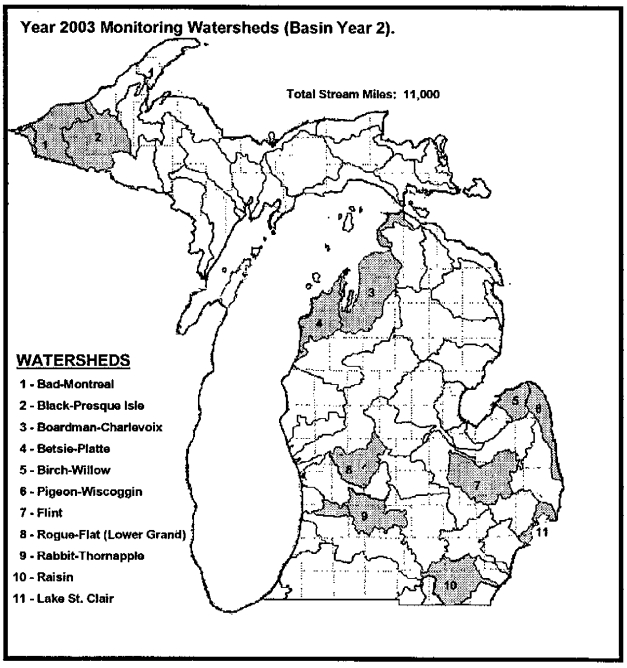

Figure 4. Intensive water chemistry trend monitoring locations and associated watersheds.

Figure 5. Integrator water chemistry trend monitoring locations and associated watersheds.

Figure 6. Comparison of total phosphorus concentrations among intensively monitored sites. Double circle designates median. All sites were sampled 6 times in 2000; fewer than 6 data points indicates identical results obtained for multiple samples.

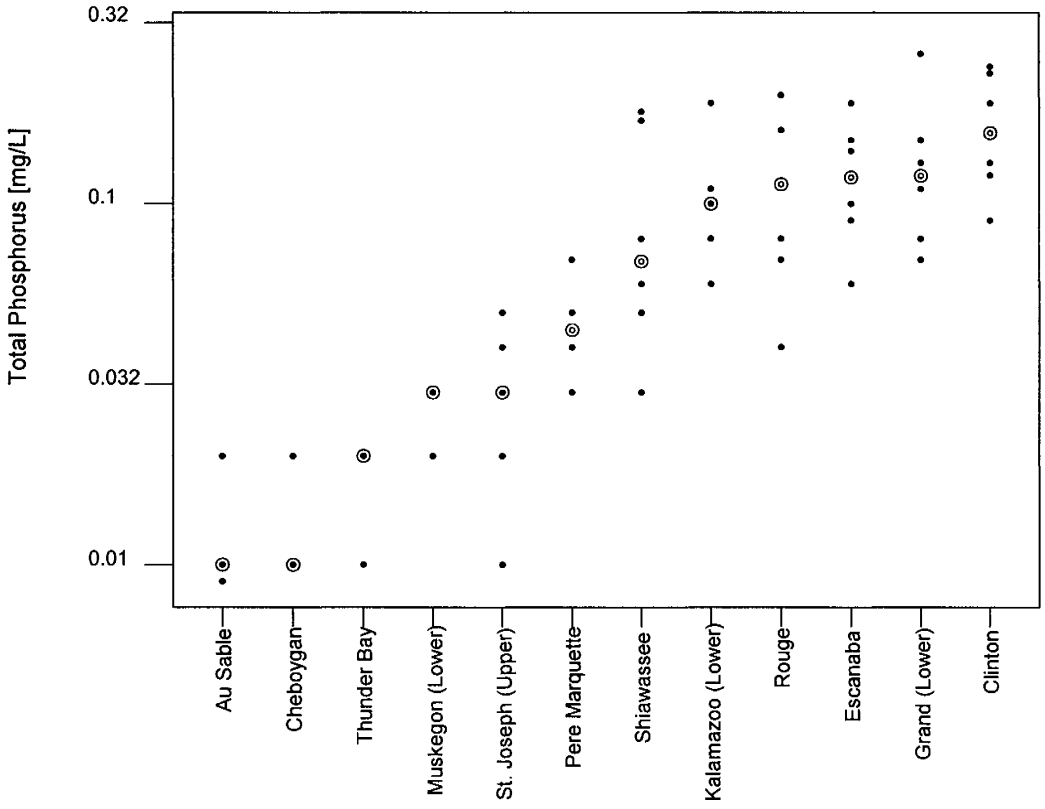

Figure 7. Comparison of total chloride concentrations among intensively monitored sites. Double circle designates median. All sites were sampled 6 times in 2000; fewer than 6 data points indicates identical results obtained for multiple samples.

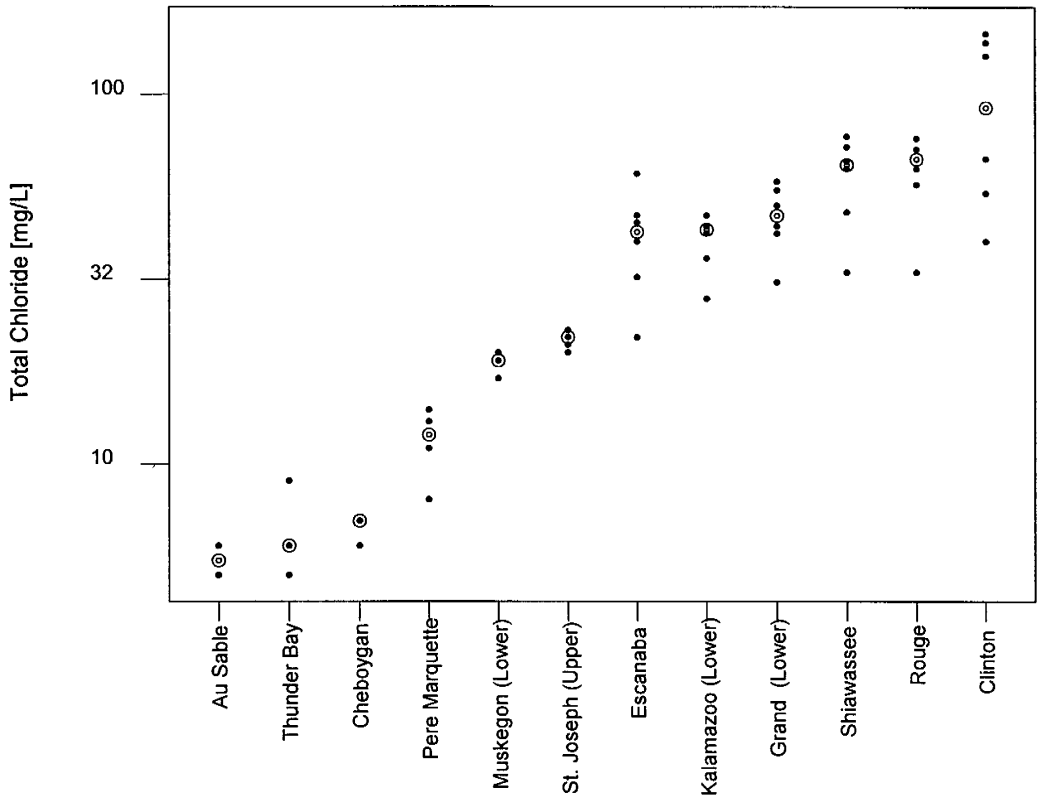

Figure 8. Comparison of total suspended solids among intensively monitored sites. Double circle designates median. All sites sampled 6 times in 2000; fewer than 6 data points indicates identical results obtained for multiple samples.

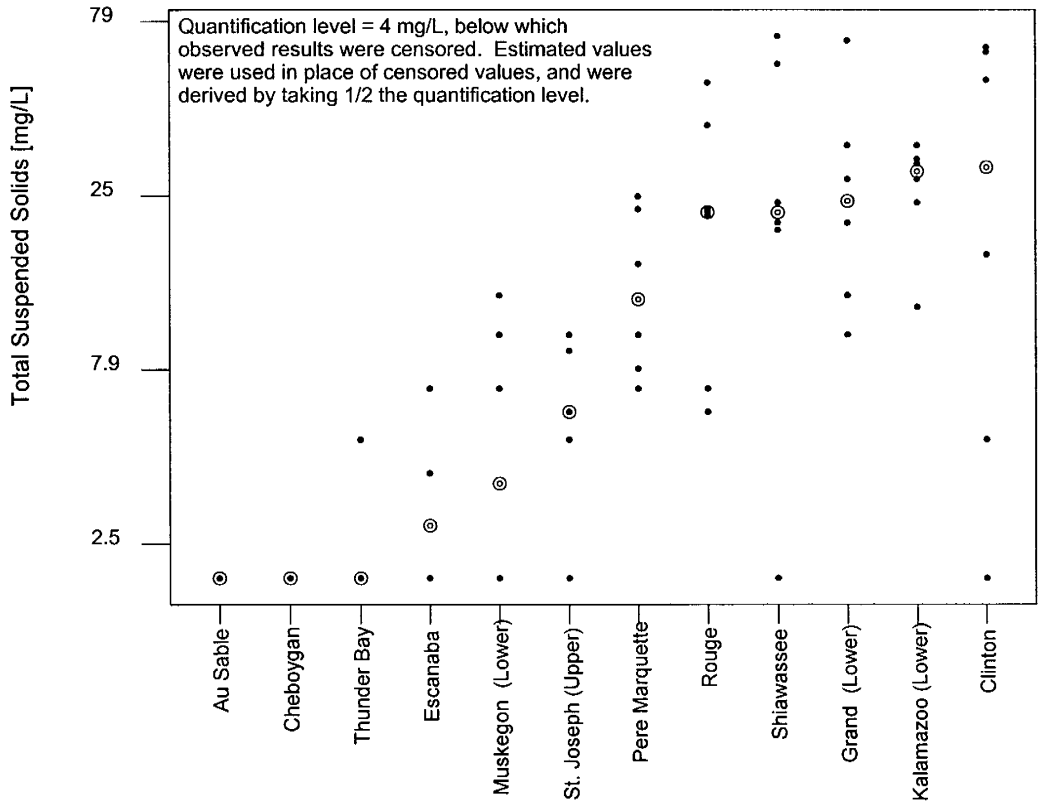

Figure 9. Comparison of total mercury concentrations among intensively monitored sites. Double circle designates median. All sites were sampled 6 times in 2000; fewer than 6 data points indicates identical results obtained for multiple samples.

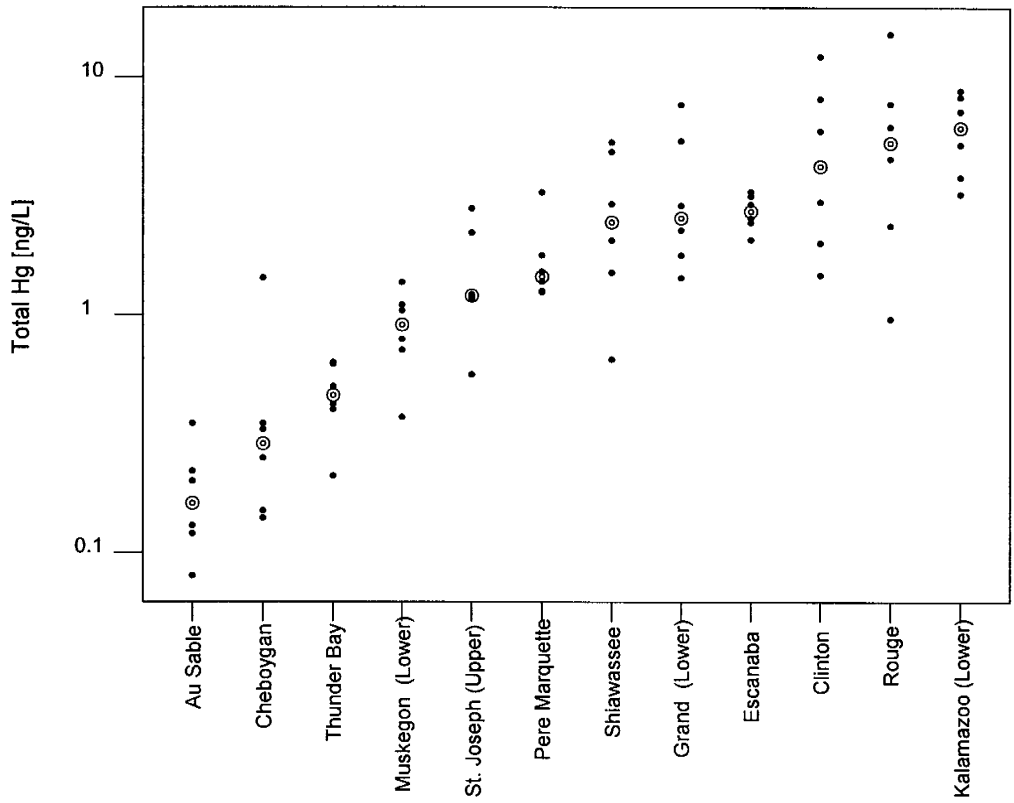

Figure 10. Comparison of total chromium concentrations among intensively monitored sites. Double circle designates median. All sites were sampled 6 times in 2000; fewer than 6 data points indicates identical results obtained for multiple samples.

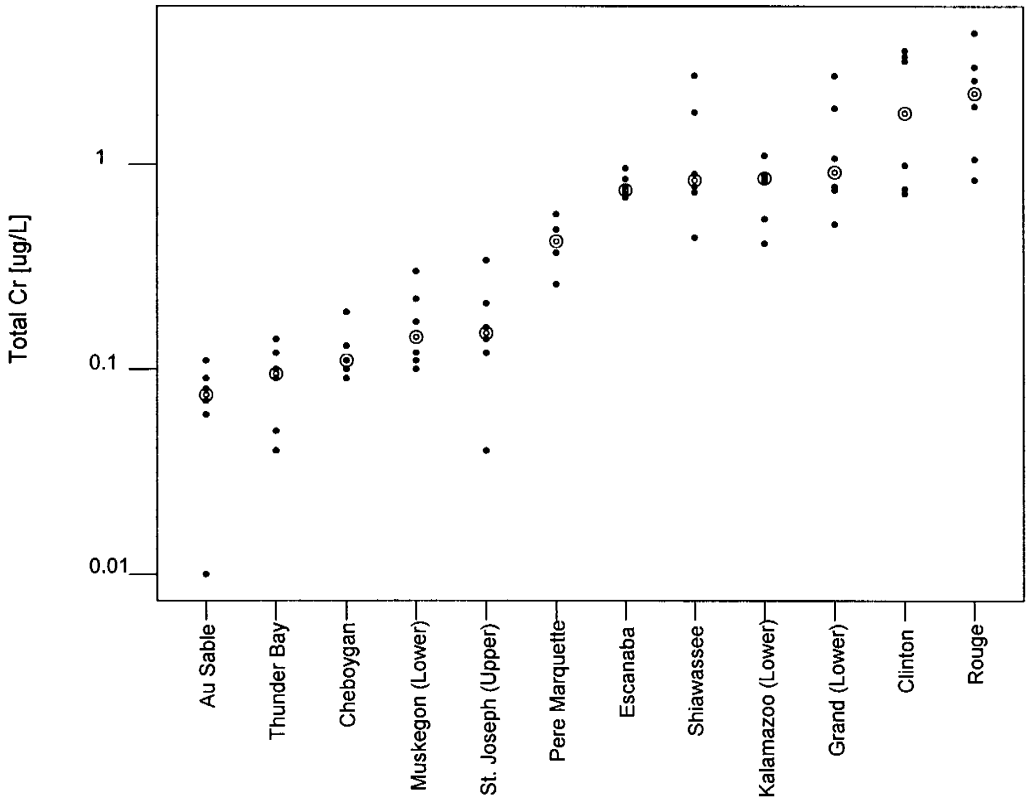

Figure 11. Comparison of total copper concentrations among intensively monitored sites. Double circle designates median. All sites were sampled 6 times in 2000; fewer than 6 data points indicates identical results obtained for multiple samples.

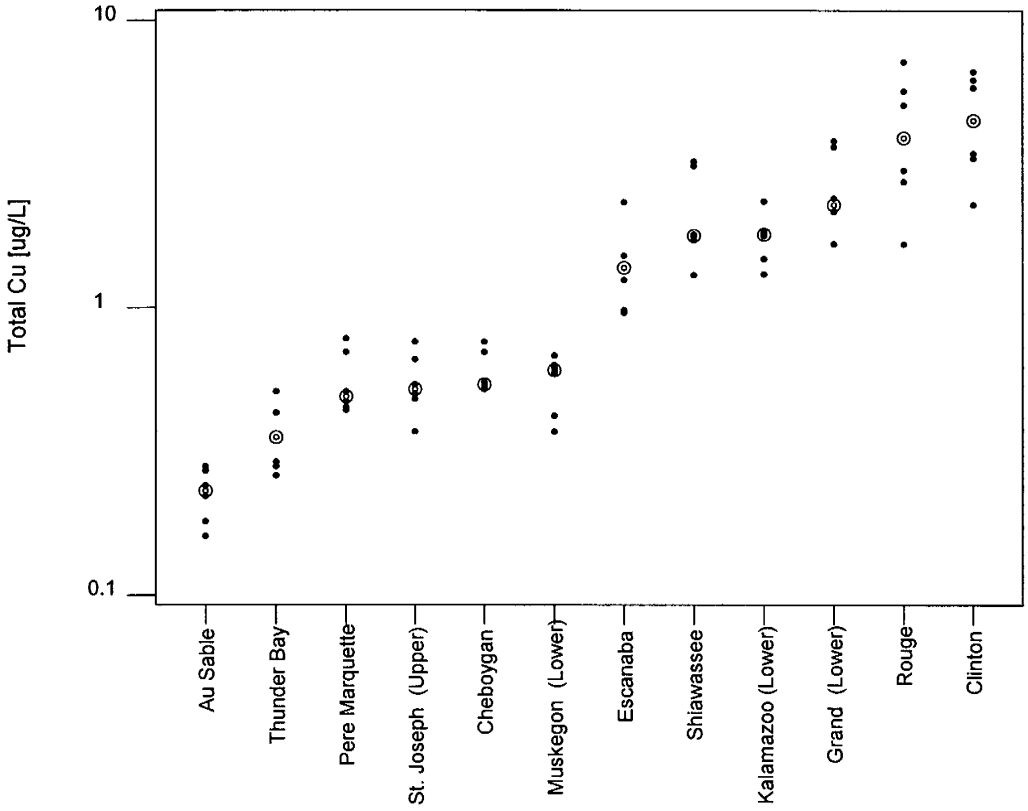

Figure 12. Comparison of total lead concentrations among intensively monitored sites. Double circle designates median. All sites were sampled 6 times in 2000; fewer than 6 data points indicates identical results obtained for multiple samples.

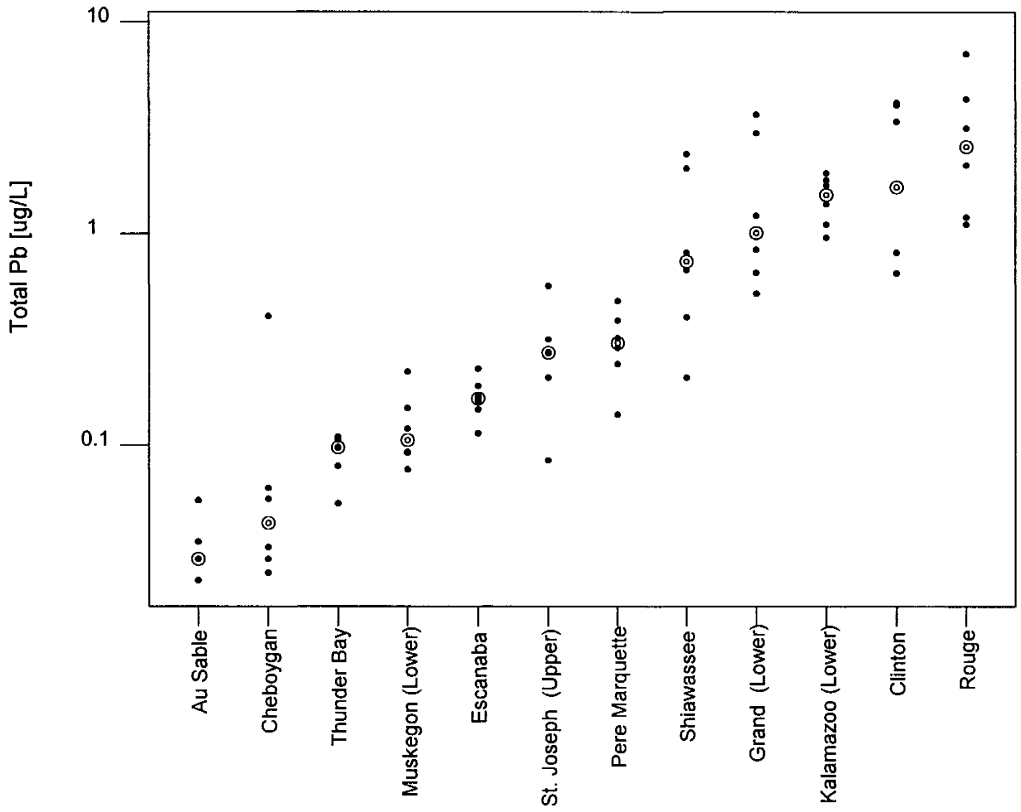

Figure 13. Comparison of total phosphorus among non-intensively monitored sites. Double circle designates median. All sites sampled 3 times in 2000; fewer than 3 data points indicates identical results obtained for multiple samples.

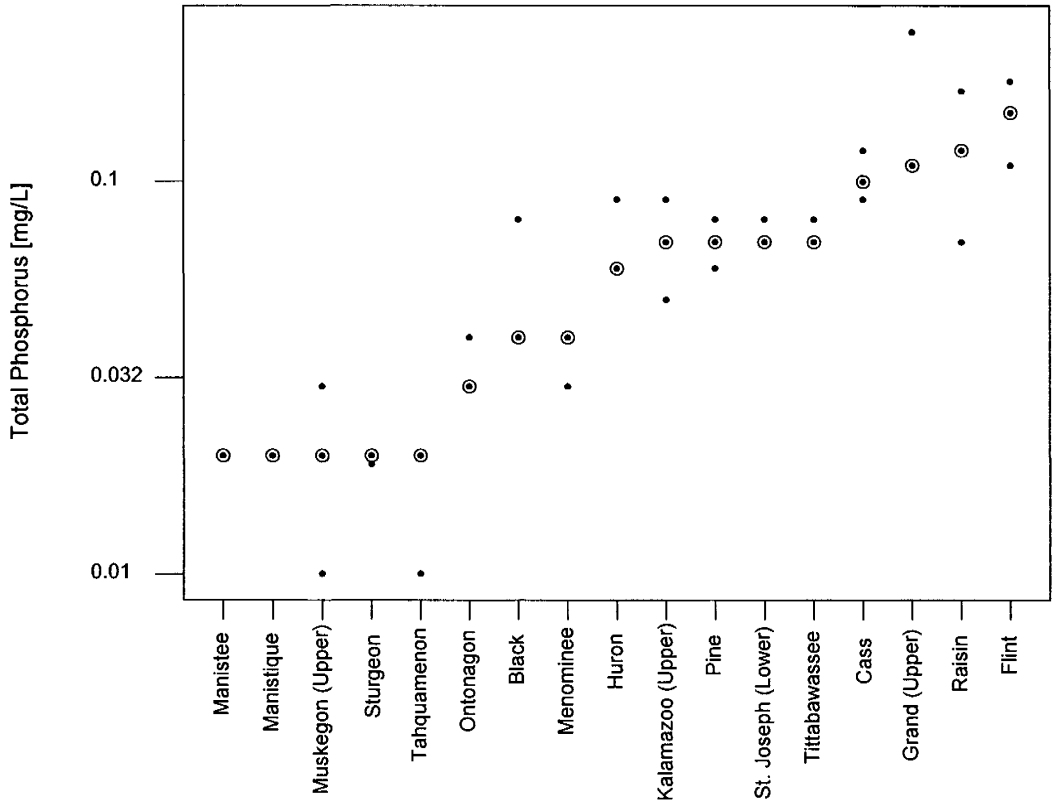

Figure 14. Comparison of total chloride among non-intensively monitored sites. Double circle designates median. All sites sampled 3 times in 2000; fewer than 3 data points indicates identical results obtained for multiple samples.

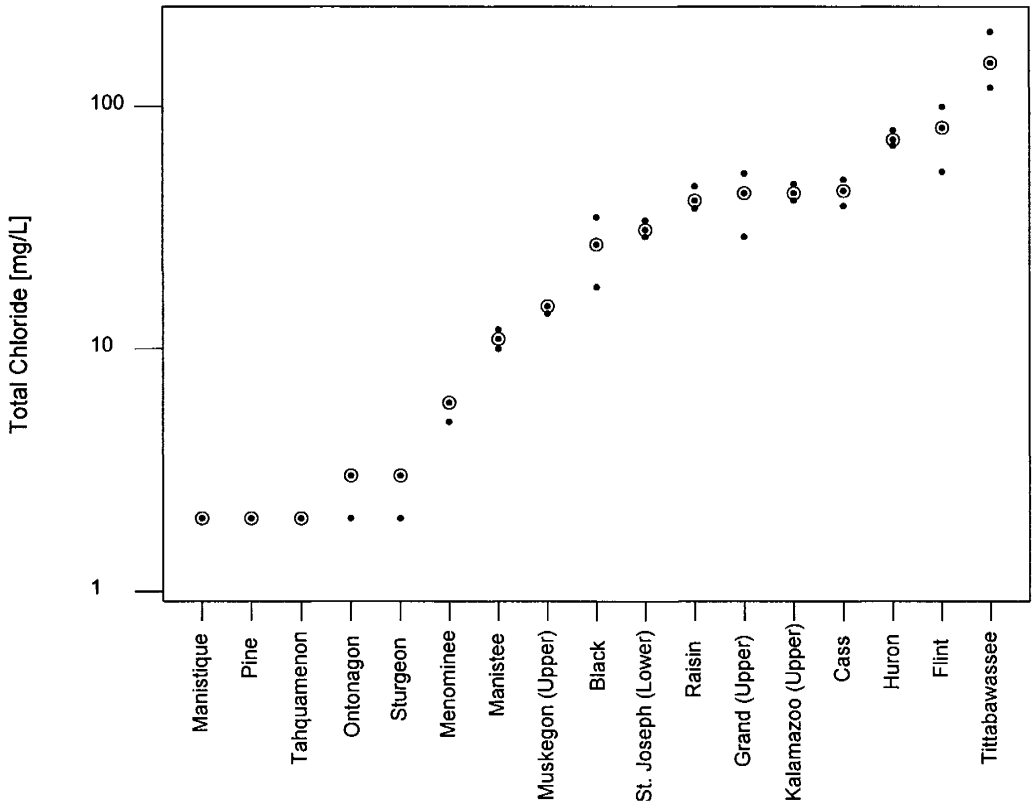

Figure 15. Comparison of total suspended solids among non-intensively monitored sites. Double circle designates median. All sites sampled 3 times in 2000; fewer than 3 data points indicates identical results obtained for multiple samples.

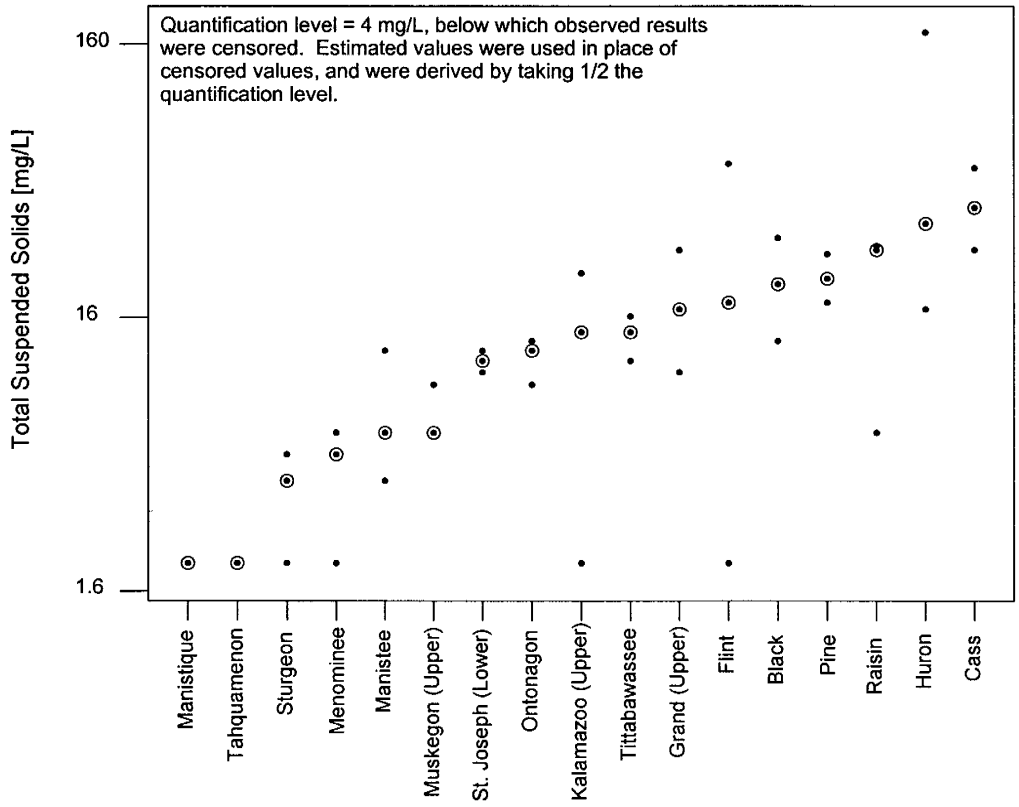

Figure 16. Comparison of total mercury concentrations among non-intensively monitored sites. Double circle designates median. All sites sampled 3 times in 2000; fewer than 3 data points indicates identical results obtained for multiple samples.

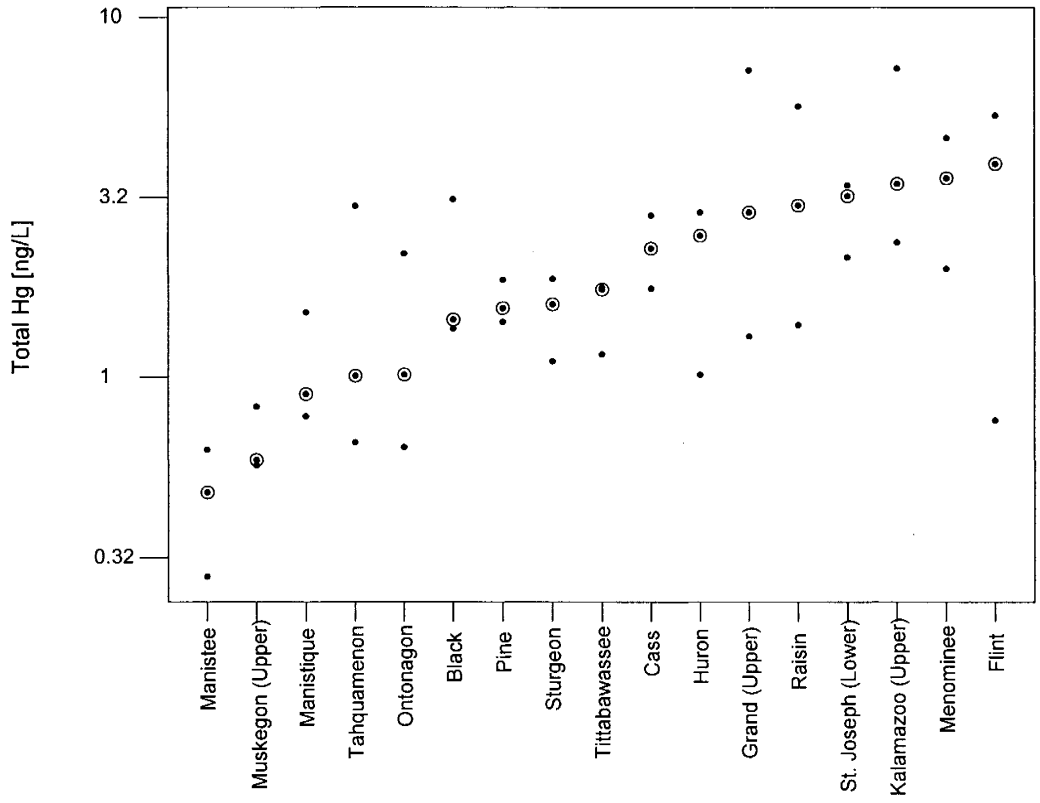

Figure 17. Comparison of total chromium among non-intensively monitored sites. Double circle designates median. All sites sampled 3 times in 2000; fewer than 3 data points indicates identical results obtained for multiple samples.

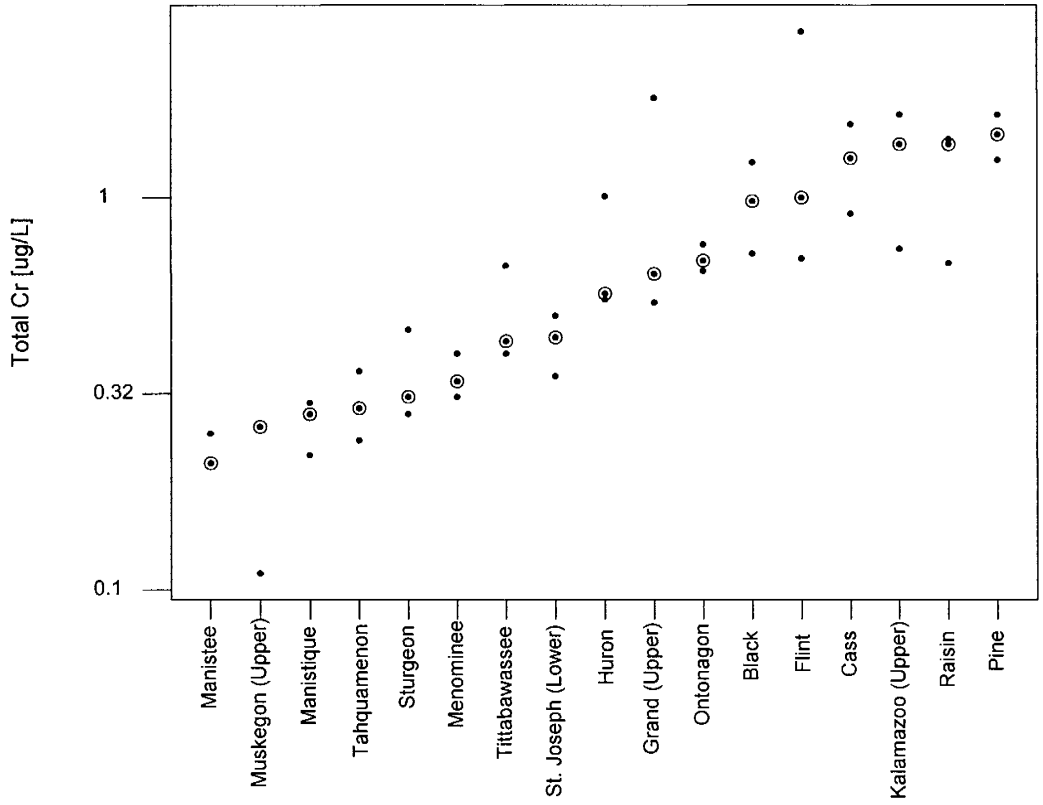

Figure 18. Comparison of total copper among non-intensively monitored sites. Double circle designates median. All sites sampled 3 times in 2000; fewer than 3 data points indicates identical results obtained for multiple samples.

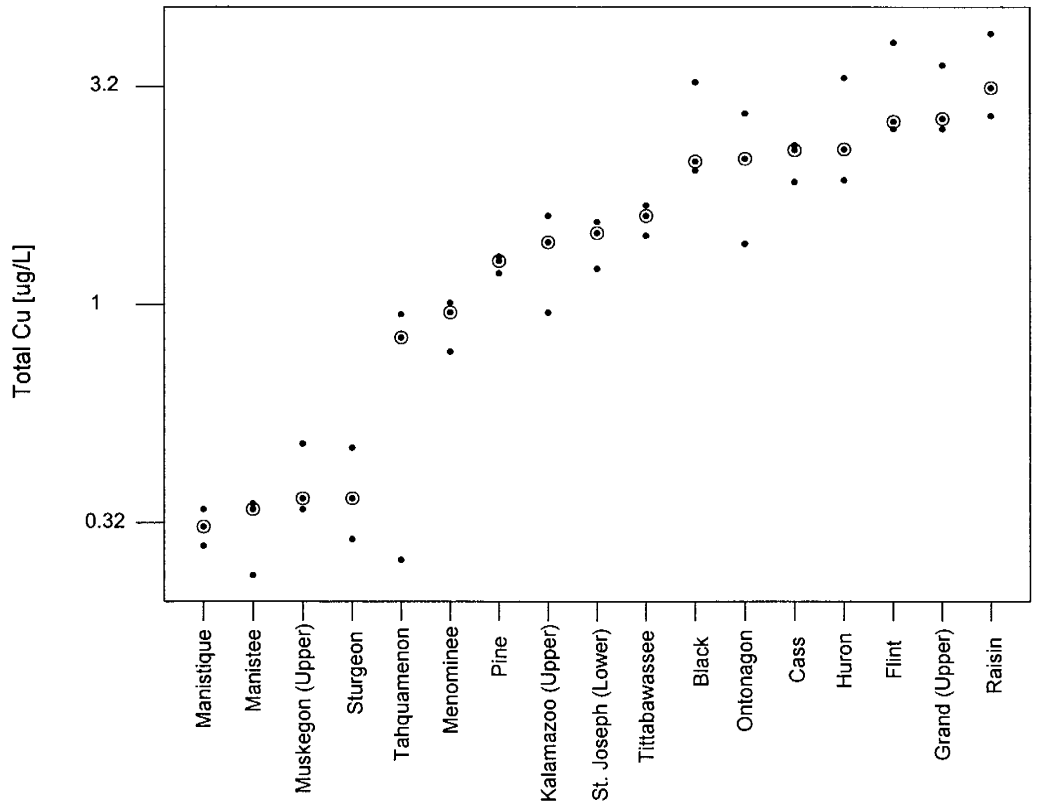

Figure 19. Comparison of total lead among non-intensively monitored sites. Double circle designates median. All sites sampled 3 times in 2000; fewer than 3 data points indicates identical results obtained for multiple samples.

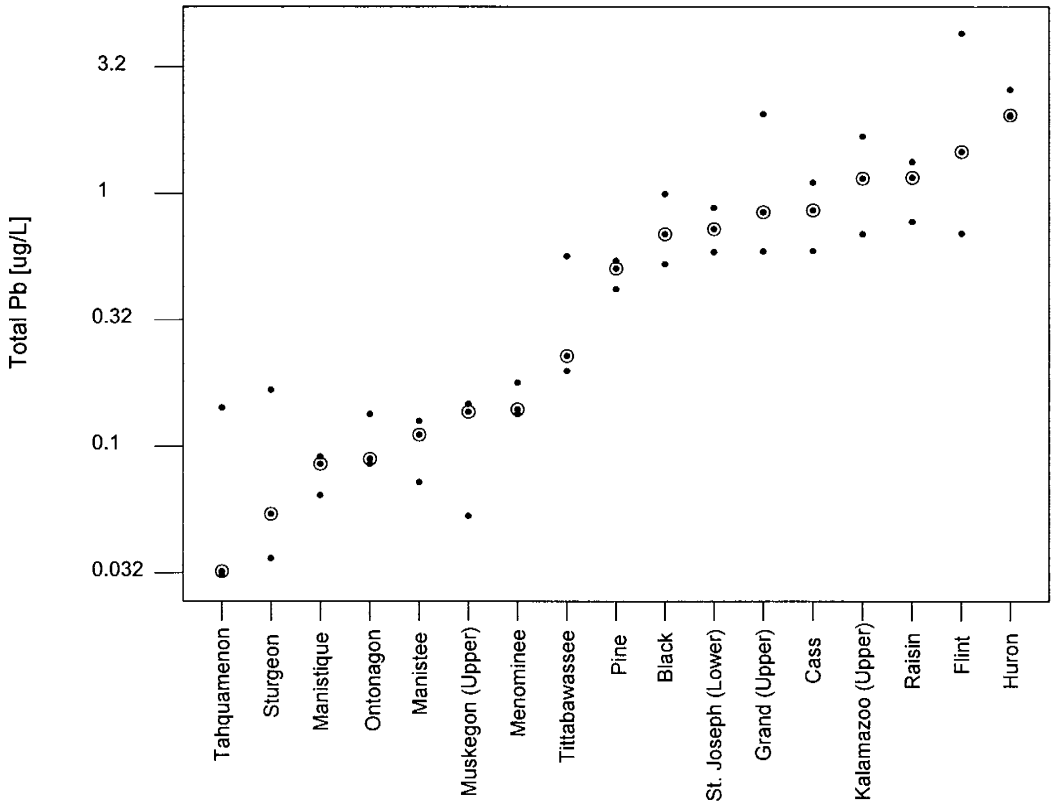

Figure 20. Comparison of total PCB concentrations among all stations sampled in 2000.

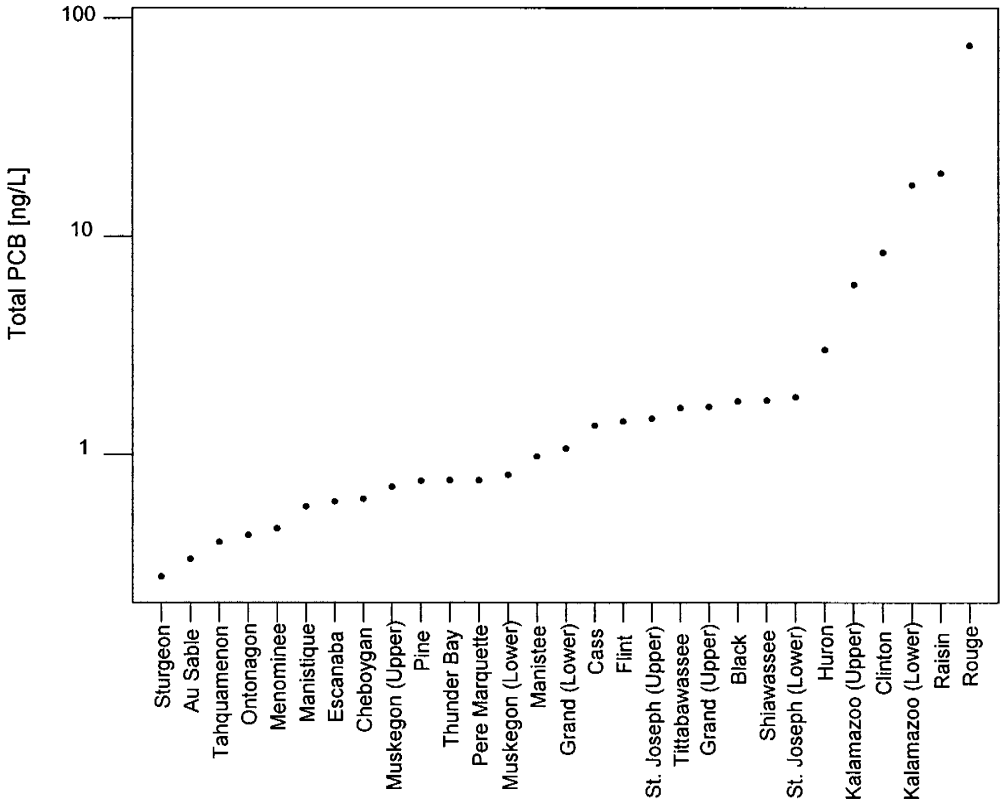

Figure 21. AuSable River hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

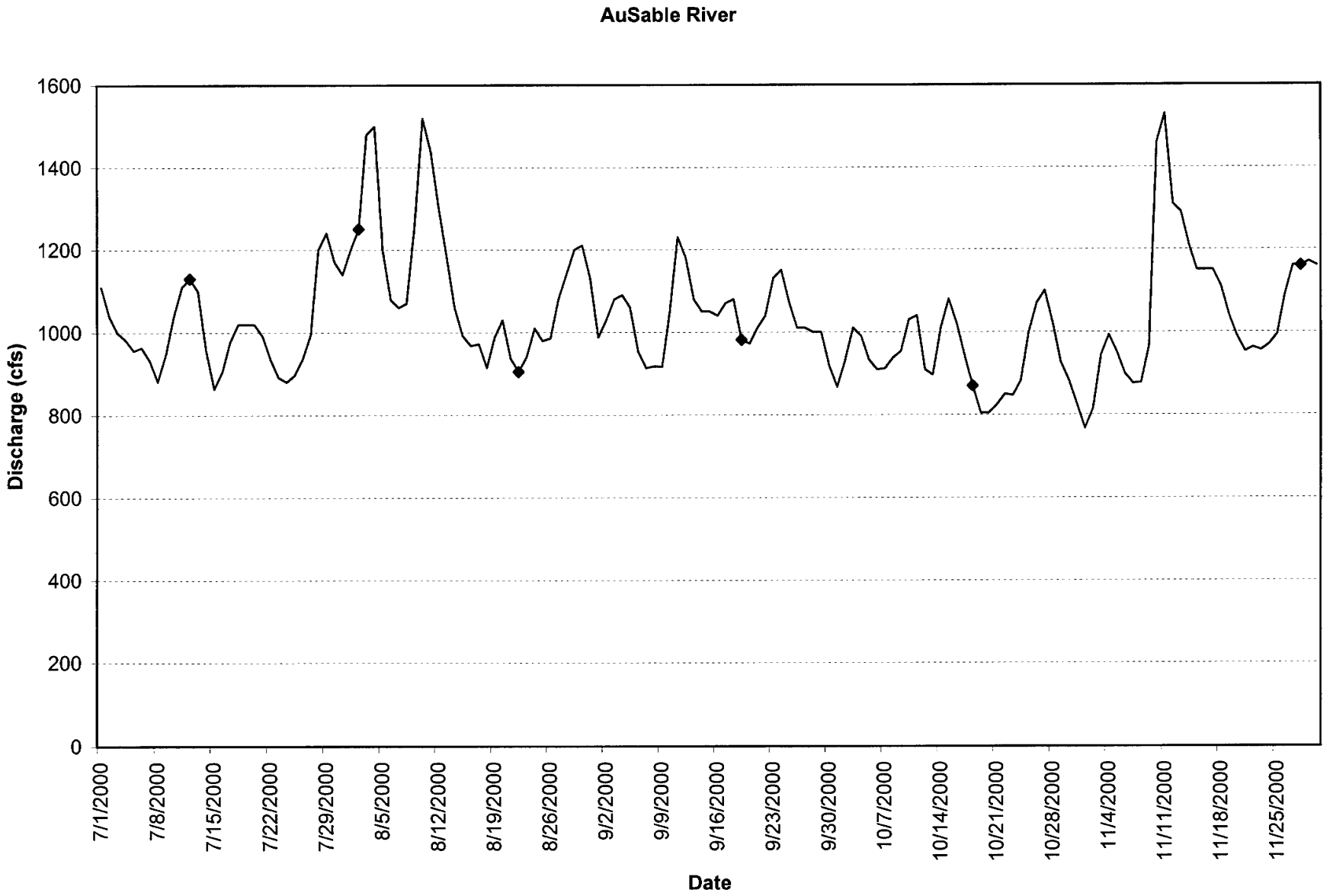

Figure 22. Cheboygan River hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

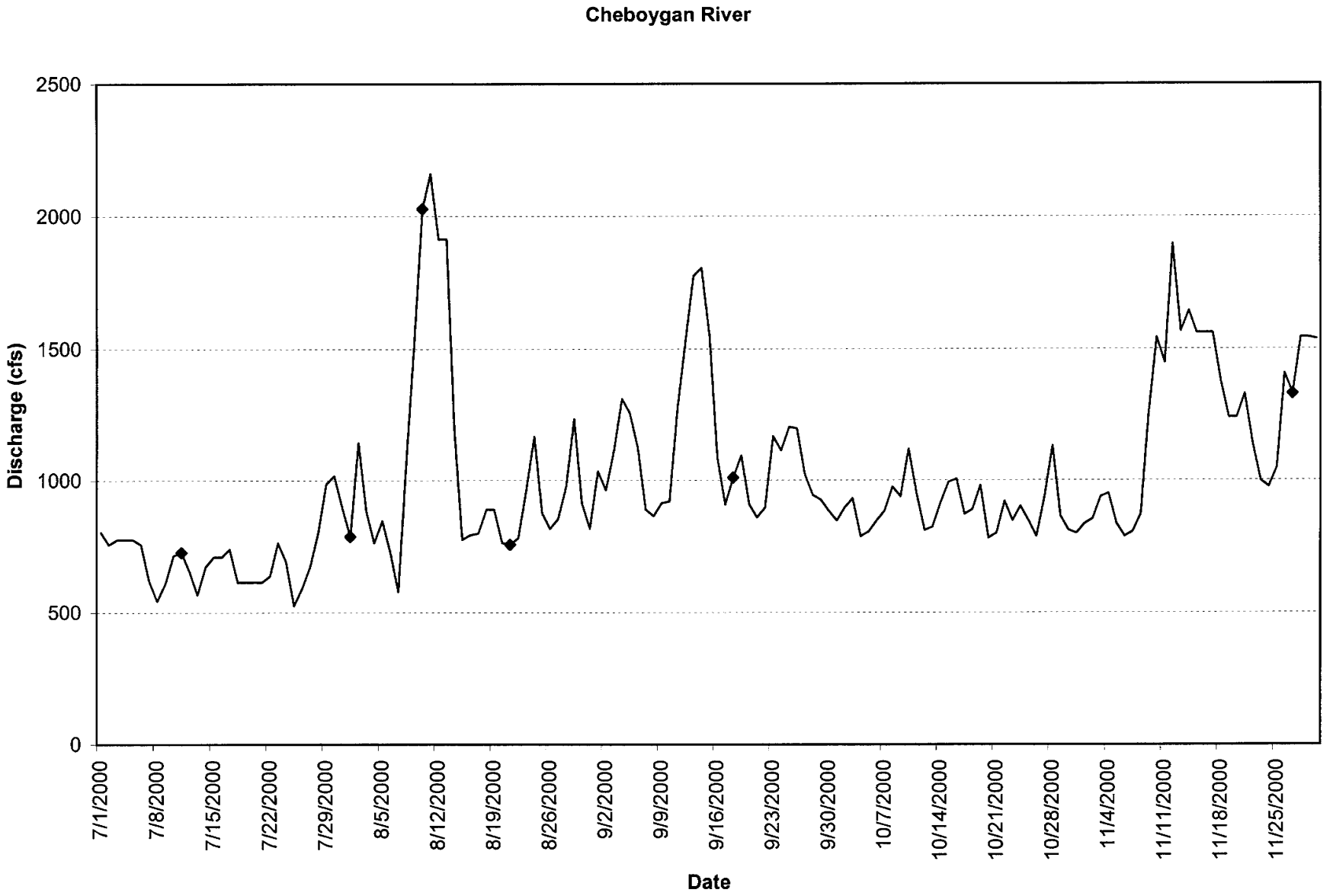

Figure 23. Clinton River hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

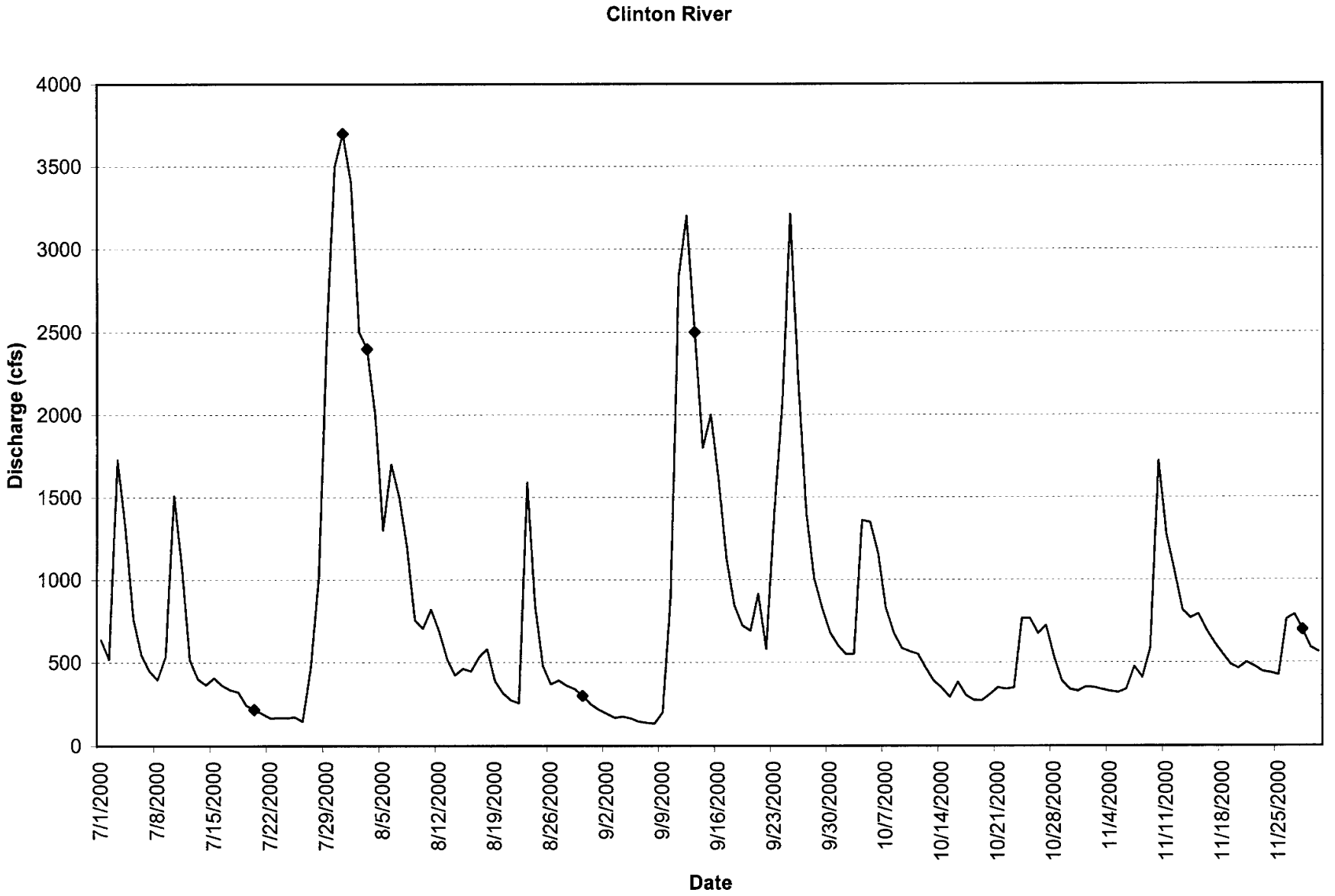

Figure 24. Escanaba River hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

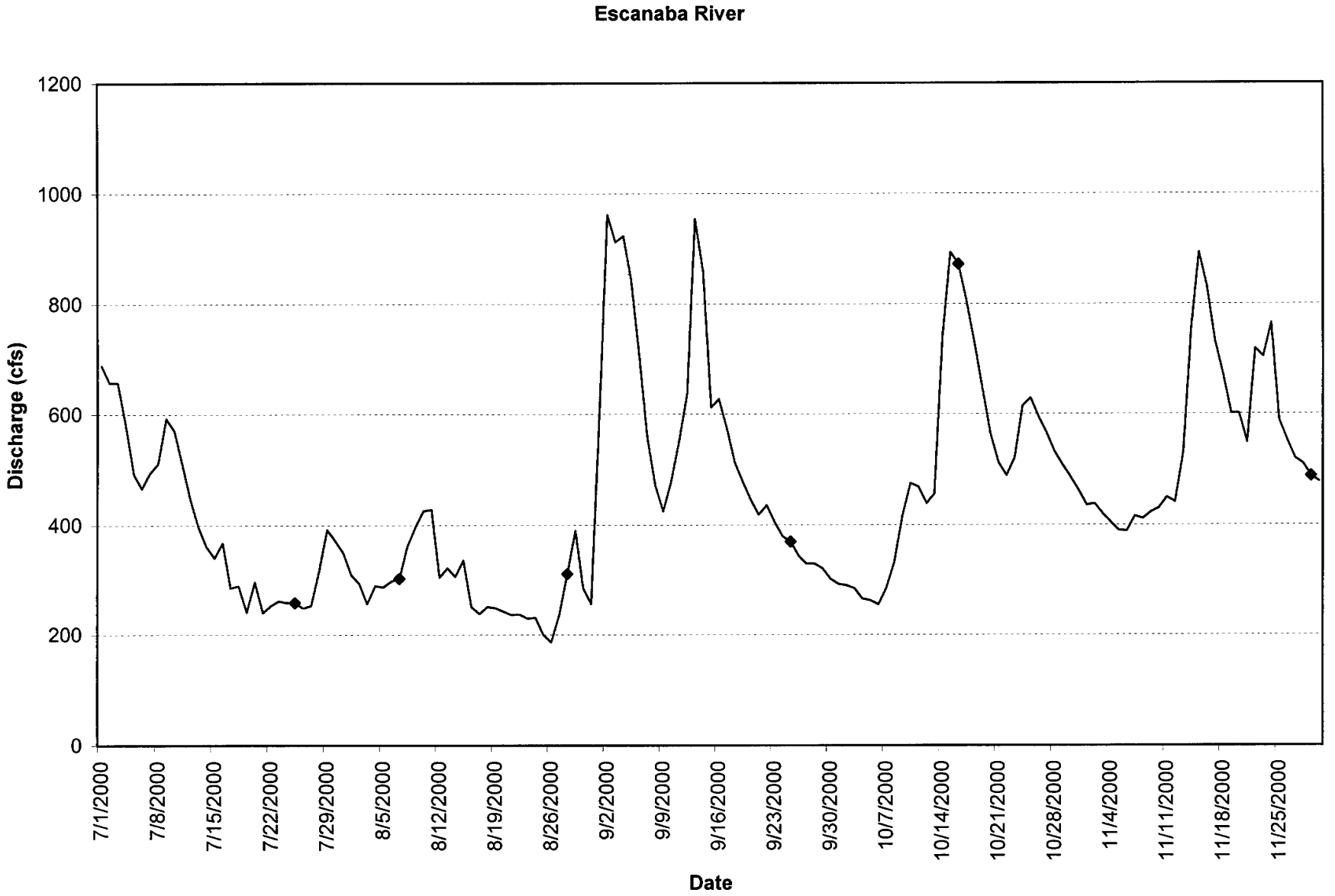

Figure 25. Grand River (lower) hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

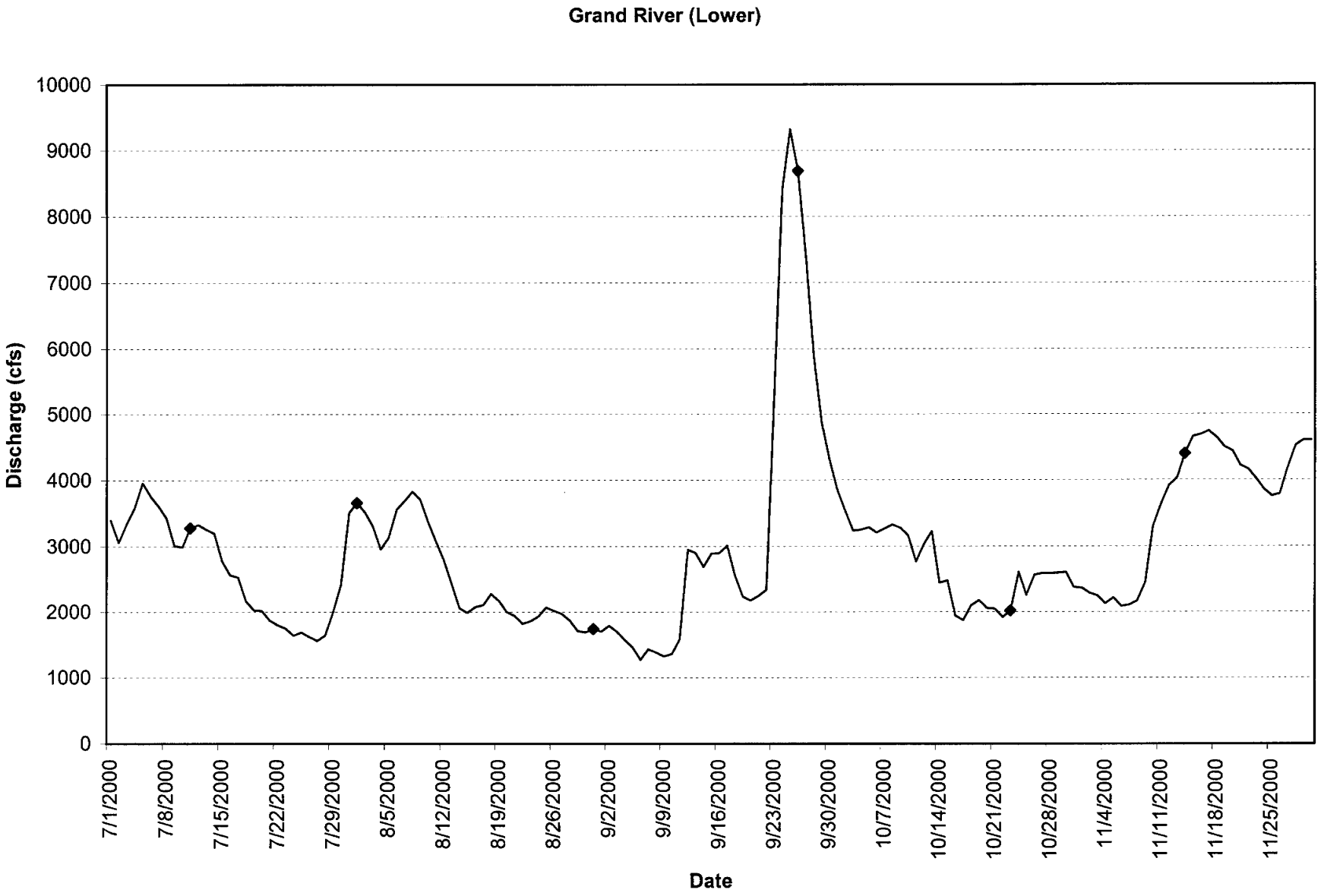

Figure 26. Kalamazoo River (lower) hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

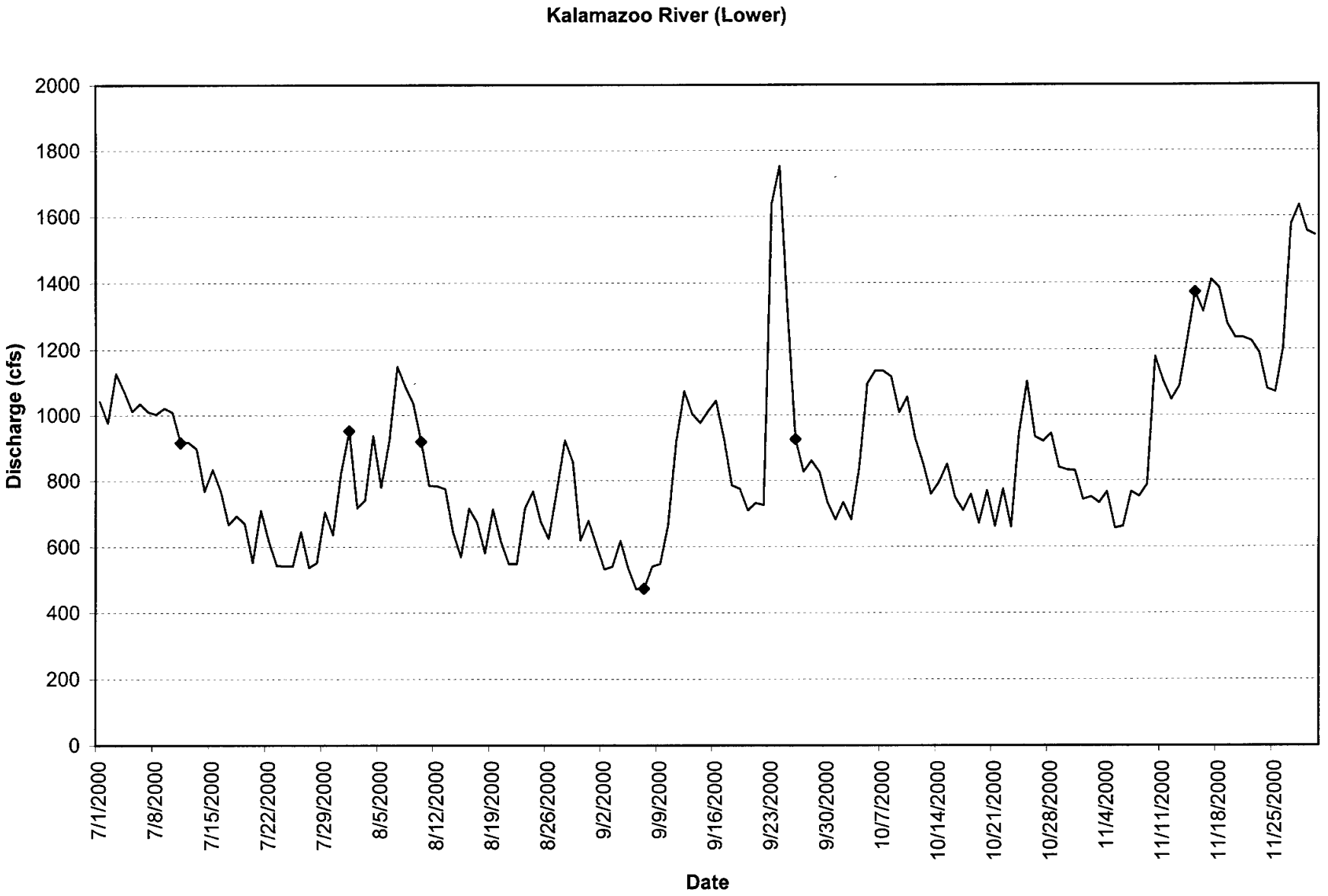

Figure 27. Muskegon River (lower) hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

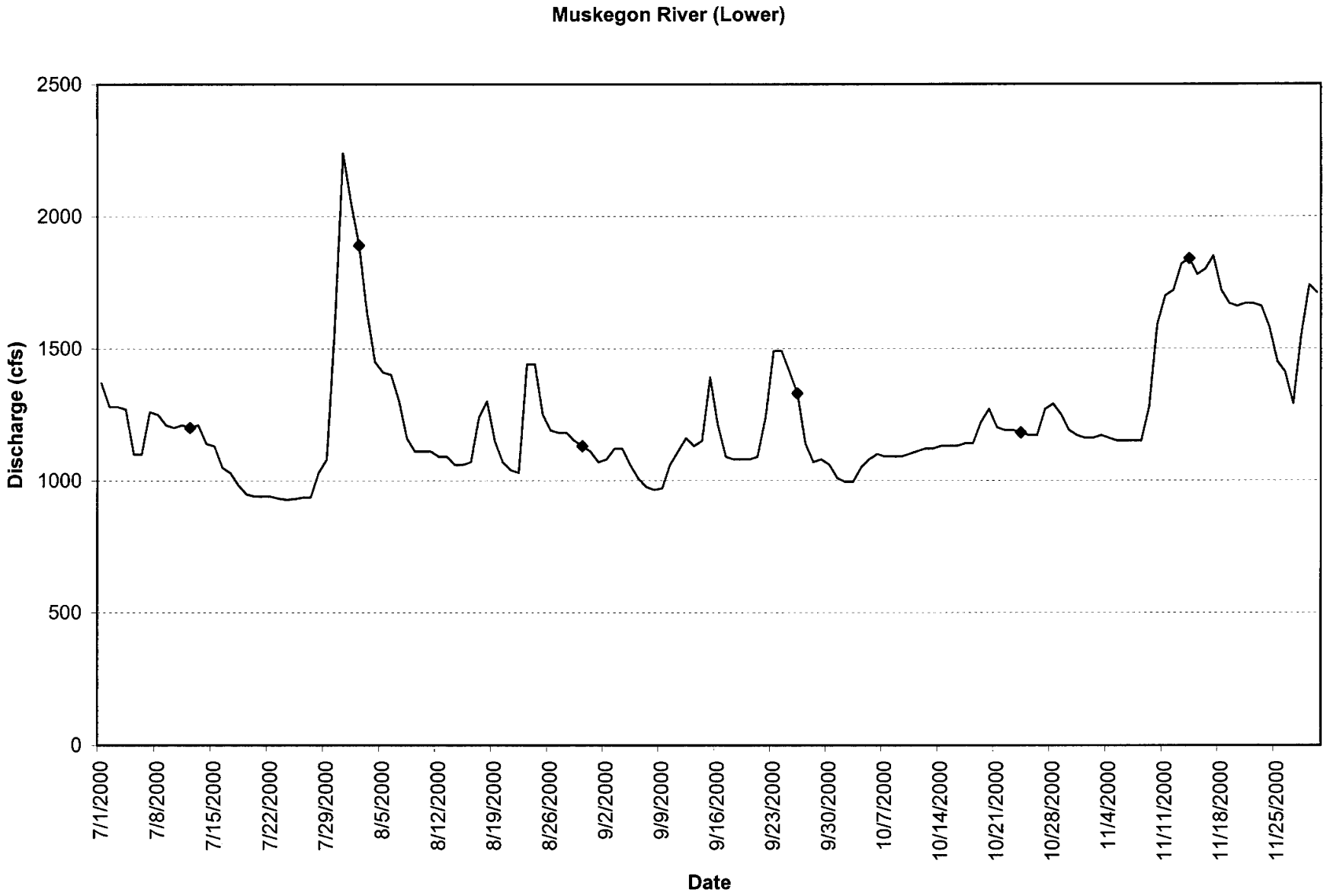

Figure 28. Pere Marquette River hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

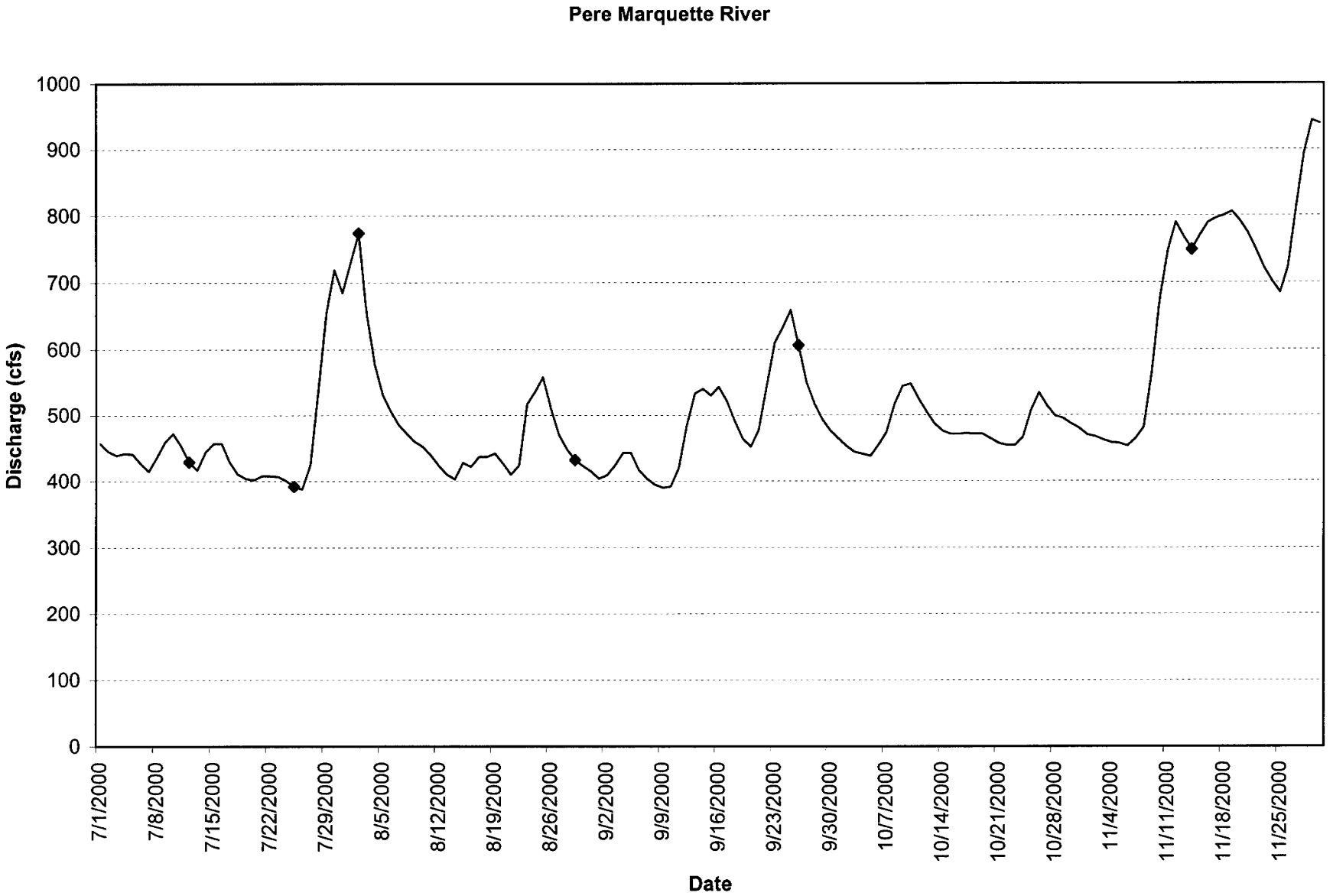

Figure 29. River Rouge hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

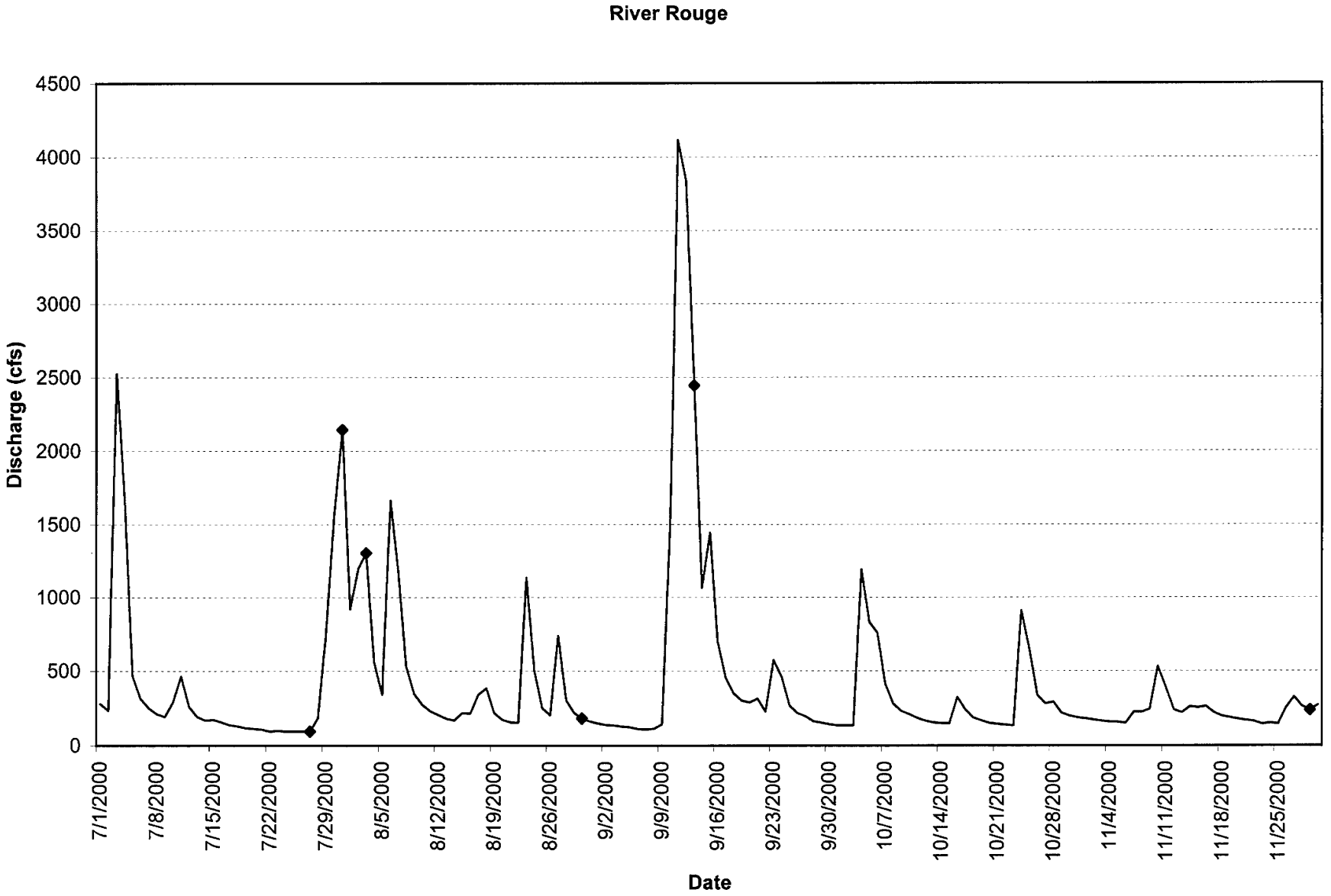

Figure 30. Shiawassee River hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

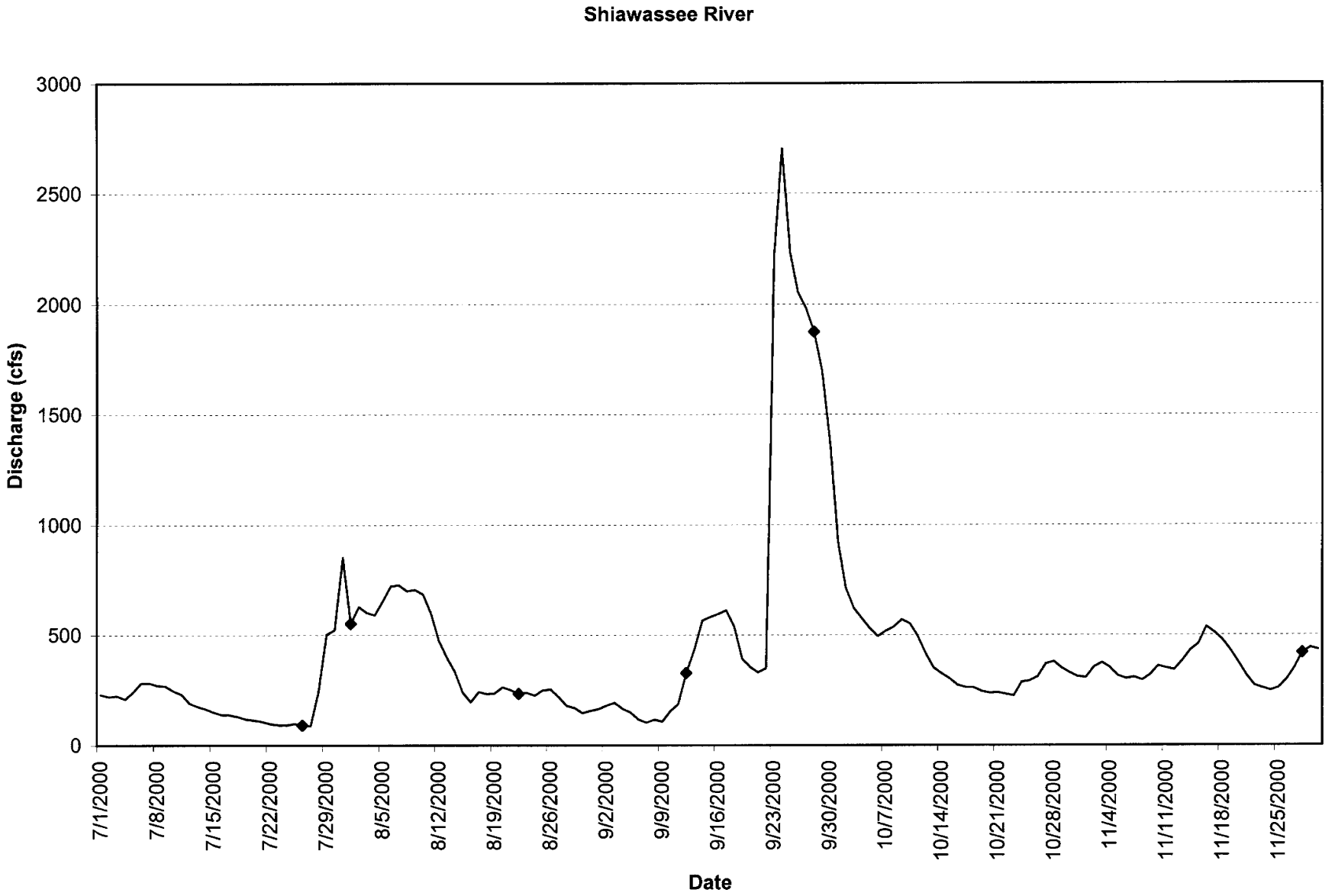

Figure 31. St. Joseph River (upper) hydrograph. Solid diamonds indicate points on hydrograph at which samples were collected.

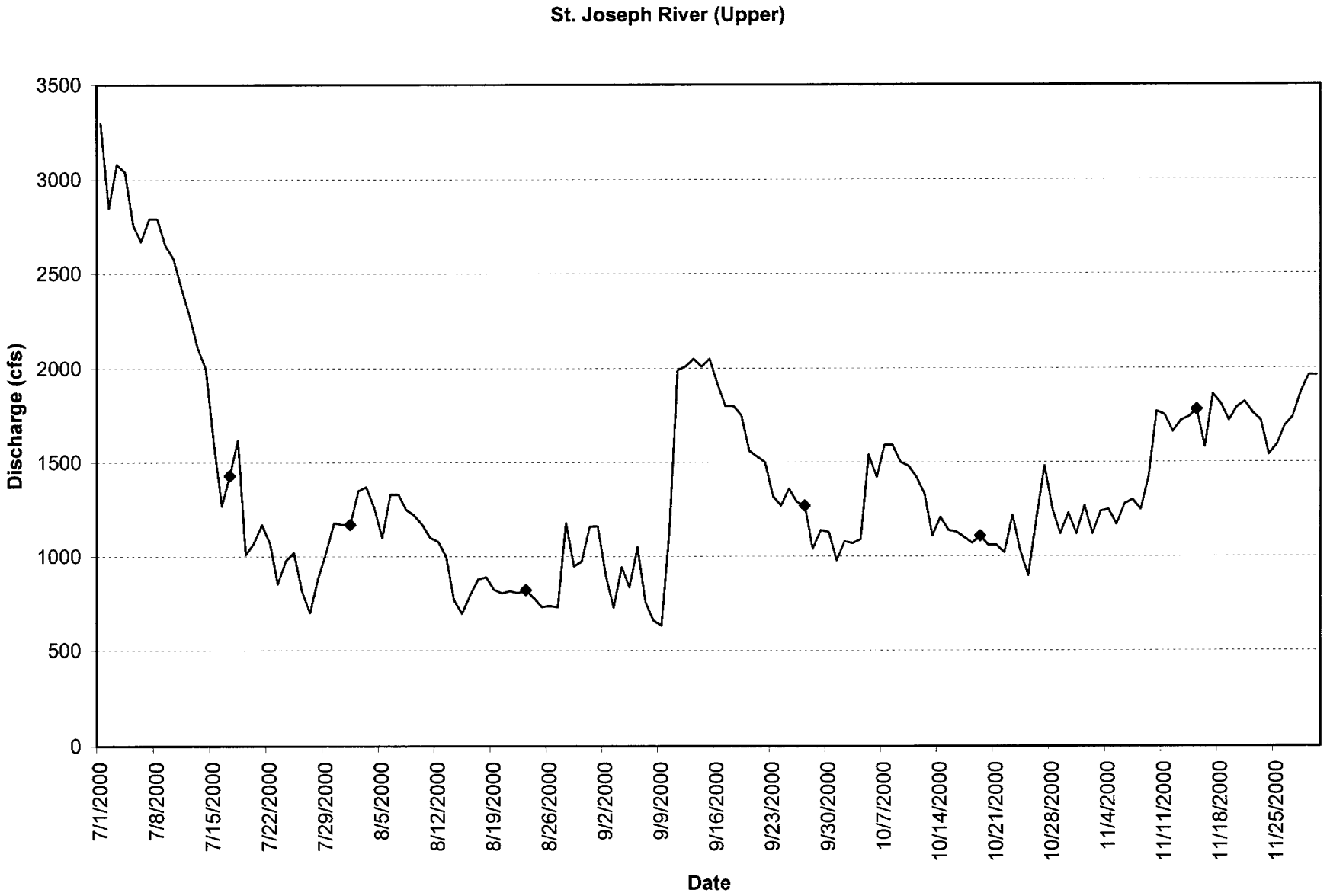

Table 1. Watershed and station location information.

Tributary	Station Location	County	STORET ID#	Latitude Longitude
Intensive Sites				
AuSable	Rea Rd. below Foote Dam, Oscoda Twp.	Iosco	350061	44.43611 °N, - 83.43417 °W
Clinton	Shadyside Pk., Gratiot Ave., city of Mt. Clemens	Macomb	500233	42.58417 °N, - 82.88278 °W
Grand (Lower)	Riverside Pk., vic. of Ottawa Ctr., Robinson Twp.	Ottawa	700123	43.02667 °N, - 86.03389 °W
Kalamazoo (Lower)	57th St., vic. New Richmond, Manlius Twp.	Allegan	030077	42.65111 °N, - 86.10611 °W
Muskegon (Lower)	Maple Island Rd.	Muskegon	610273	43.31778 °N, - 86.03889 °W
Saginaw	*Main St., City of Essexville*	*Bay*	*090177*	*43.61751 °N, - 83.84278 °W*
Integrator Sites - Year 2000 Intensively Monitored				
Cheboygan	Lincoln Ave., city of Cheboygan	Cheboygan	160073	45.63334 °N, - 84.48195 °W
Escanaba	0.35mi US of Soo Line RR Bridge	Delta	210102	45.80028 °N, - 87.09583 °W
Pere Marquette	Main St., city of Scottville, Custer/Amber Twp.	Mason	530027	43.94444 °N, - 86.28000 °W
Rouge	W. Jefferson Ave. Bridge	Wayne	820070	42.28056 °N, - 83.12889 °W
Shiawassee	Fergus Rd. Bridge, St. Charles Twp.	Saginaw	730023	43.25472 °N, - 84.10556 °W
St. Joseph (Upper)	Rt. 12 Bridge, city of Mottville	St. Joseph	750273	41.80003 °N, - 85.75694 °W
Thunder Bay	Bagley St. Bridge, Alpena Twp.	Alpena	040123	45.06694 °N, - 83.47194 °W
Integrator Sites - Year 2000 Non-Intensively Monitored				
Black	Water St. boat launch DS of RR bridge	St. Clair	740385	42.97356 °N, - 82.42029 °W
Boardman	*Beitner Rd., Garfield Twp., Sec. 3*	*Grand Traverse*	*280014*	*44.67528 °N, - 85.63070 °W*
Cass	M-13 bridge, Spaulding Twp., Sec. 12	Saginaw	730024	43.36500 °N, - 83.95473 °W
Flint	M-13, Spaulding Twp.	Saginaw	730285	43.30857 °N, - 83.95328 °W
Grand (Upper)	M-66 bridge, Ionia Twp. Sec. 30	Ionia	340025	42.97195 °N, - 85.07000 °W
Huron	2000' DS of Rockwood WWTP, Berlin Twp.	Monroe	580364	42.04528 °N, - 83.21417 °W
Kalamazoo (Upper)	G Ave. bridge, city of Augusta	Kalamazoo	390057	42.33528 °N, - 85.34528 °W
Manistee	M-55 bridge, Manistee Twp., Sec. 31	Manistee	510088	44.26430 °N, - 86.29538 °W
Manistique	Vic.old RR bridge N.of old US-2, city of Manistique	Schoolcraft	770073	45.96889 °N, - 86.24611 °W
Menominee	26th St. bridge, city of Menominee	Menominee	550038	45.10625 °N, - 87.63556 °W
Muskegon (Upper)	Hersey Rd. bridge, Hersey Twp.	Osceola	670008	43.84722 °N, - 85.43231 °W
Ontonagon	RR bridge, Ontonagon, Sec 25	Ontonagon	660038	46.86751 °N, - 89.31695 °W
Pine	M-134 bridge, St. Ignace Twp. Sec. 10	Mackinac	490006	46.05117 °N, - 84.65681 °W
Raisin	ERA Dock, city of Monroe	Monroe	580046	41.90056 °N, - 83.35444 °W
St. Joseph (Lower)	River Pk. off Zollar Dr.	Berrien	110628	42.06333 °N, - 86.44889 °W
Sturgeon	Co Rd. 499, Nahma Twp., Sec. 20	Delta	210032	45.83417 °N, - 86.66862 °W
Tahquamenon	State Campground on U.S.123	Chippewa	170141	46.55583 °N, - 85.03889 °W
Tittabawassee	Central Rd. bridge, Spaulding Twp.	Saginaw	730025	43.39278 °N, - 84.01111 °W

Note: Stations in italics were not sampled in 2000.

Table 2. Nutrients and conventionals analyzed for the WCTMP, and their analytical quantification levels.

Analyte	Quantification Level (mg/L)
Ammonia	0.01
Carbon, Total Organic	0.5
Chloride	1.0
Conductivity*	
Hardness (Ca2CO3)	5.0
Nitrate#	
Nitrite	0.01
Nitrogen, Kjeldahl	0.1
Oxygen, Dissolved*	
pH*	
Phosphate, Ortho	0.01
Phosphorous, Total	0.01
Solids, Total Dissolved#	
Solids, Total Suspended	4.0
Sulfate	2.0
Temperature*	
Turbidity	0.40^

* = Field measured; may additionally be measured in the laboratory.

= Calculated from other independent parameters.

^ = NTU

Table 3. Base/neutral organics analyzed for the WCTMP, and their analytical quantification levels and Michigan Rule 57 water quality values.

Base / Neutral Organics	Quantification Level (ug/L)	R. 57 Water Quality Value (ug/L)
	Group 1	
1,2,4-Trichlorobenzene	2.0	FCV = 30
1,2-Dichlorobenzene	1.0	FCV = 16
1,3-Dichlorobenzene	1.0	FCV = 38
1,4-Dichlorobenzene	1.0	FCV = 13
2-Methylnaphthalene	5.0	FCV = 12
Acenaphthene	1.0	FCV = 19
Acenaphthylene	1.0	FCV = 7.2
Anthracene	1.0	FCV = 2.8
Benzo(a)anthracene	1.0	FCV = 2.6
Bis(2-chloroisopropyl)ether	1.0	HCV = 290
Bis(2-ethylhexyl)phthalate	2.0	HCV = 32
Butyl benzyl phthalate	1.0	FCV = 14
Chrysene	1.0	HCV = 1.5
Di-n-butyl phthalate	1.0	FCV = 9.7
Di-n-octyl phthalate	2.0	HNV = 300
Fluoranthene	1.0	FCV = 1.6
Fluorene	1.0	FCV = 12
Hexachloroethane	1.0	HCV = 6.7
Isophorone	1.0	FCV = 570
Naphthalene	1.0	FCV = 13
Nitrobenzene	2.0	HCV = 180
Phenanthrene	1.0	FCV = 2.4
Pyrene	1.0	FCV = 2.5
	Group 2	
Carbazole	10	FCV = 4
Dibenzofuran	5.0	FCV = 4
Hexachlorobutadiene	2.0	WV = 0.053
Hexachlorocyclopentadiene	10	FCV = 0.07
	Group 3	
2,4-Dinitrotoluene	5.0	*
2,6-Dinitrotoluene	5.0	*
2-Chloronaphthalene	2.0	*
2-Nitroaniline	20	*
3-Nitroaniline	20	*
4-Bromophenyl phenylether	2.0	*
4-Chlorophenyl phenylether	1.0	*
4-Nitroaniline	20	*
Azobenzene	2.0	*
Benzo(a)pyrene	2.0	*
Benzo(b)fluoranthene	2.0	*
Benzo(g,h,i)perylene	2.0	*
Benzo(k)fluoranthene	2.0	*
Bis(2-chloroethoxy)methane	2.0	*
Bis(2-chloroethyl)ether	1.0	*
Dibenz(a,h)anthracene	2.0	*
Diethyl phthalate	1.0	*
Dimethyl phthalate	2.0	*
Indeno(1,2,3-cd)pyrene	2.0	*
N-Nitrosodimethylamine	5.0	*
N-Nitrosodi-n-propylamine	2.0	*
N-Nitrosodiphenylamine	2.0	*

FCV = Final Chronic Value
HCV = Human Cancer Value - Non-Drinking Water
HNV = Human Non-Cancer Value - Non-Drinking Water
* = Michigan Rule 57 water quality value has not been developed for this analyte.

Table 4. BTEX and MTBE, and their analytical quantification levels and Michigan Rule 57 water quality values.

BTEX / MTBE	Quantification Level (ug/L)	R. 57 Water Quality Value (ug/L)
Benzene	1.0	FCV = 200
Toluene	1.0	FCV = 140
Ethylbenzene	1.0	FCV = 18
m- & p-Xylene	2.0	FCV = 35*
o-Xylene	1.0	
Methyl *tert* butyl ether	5.0	FCV = 730

* = Value applies to total xylene. (Total xylene = m- & p-xylene + o-xylene).

Table 5. Mercury and trace metals analyzed for the WCTMP, and their analytical detection and quantification levels.

Analyte	Detection Level	Quantification Level	Units
Hg	0.1	0.3	ng/L
Cd	0.01	0.03	ug/L
Cr	0.02	0.06	ug/L
Cu	0.01	0.04	ug/L
Pb	0.005	0.015	ug/L
Ni	0.09	0.30	ug/L
Zn	0.04	0.13	ug/L

Table 6. PCB congeners analyzed for the WCTMP, and the analytical detection and quantification levels for a 160 liter sample.

Congener #	Detection Level (ng/L)	Quantification Level (ng/L)	Congener #	Detection Level (ng/L)	Quantification Level (ng/L)
3	0.22	0.72	97	0.0030	0.010
4/10	0.025	0.083	87	0.0050	0.017
7/9	0.0055	0.018	85	0.0055	0.018
6	0.011	0.037	136	0.015	0.050
8/5	0.024	0.080	77/110	0.011	0.037
19	0.0035	0.012	82	0.0035	0.012
18	0.0070	0.023	151	0.0050	0.017
15/17	0.015	0.050	135/144	0.0065	0.022
24/27	0.0035	0.012	123/149	0.0050	0.017
16/32	0.011	0.037	118	0.0080	0.027
26	0.0070	0.023	146	0.0055	0.018
25	0.0060	0.020	132/153/105	0.010	0.033
28/31	0.020	0.070	141	0.0040	0.013
33	0.0075	0.025	137/176	0.0065	0.022
53	0.0040	0.013	163/138	0.011	0.037
51	0.0035	0.012	158	0.0075	0.025
22	0.011	0.037	178	0.0070	0.023
45	0.0045	0.015	187/182	0.0050	0.017
46	0.0045	0.015	183	0.0055	0.018
52	0.0075	0.025	128	0.0045	0.015
49	0.0050	0.017	167	0.0060	0.020
47/48	0.0090	0.030	185	0.0035	0.012
44	0.0065	0.022	174	0.0055	0.018
37/42	0.010	0.033	177	0.0060	0.020
41/71/64	0.010	0.033	202/171	0.0040	0.013
40	0.0050	0.017	172	0.0075	0.025
63	0.012	0.040	180	0.0065	0.022
74	0.0065	0.022	193	0.0075	0.025
70/76	0.012	0.040	199	0.0045	0.015
66	0.012	0.040	170/190	0.0055	0.018
95	0.0060	0.020	198	0.0075	0.025
91	0.0055	0.018	201	0.0090	0.030
56/60	0.0080	0.027	203/196	0.014	0.047
92/84	0.012	0.040	208/195	0.0040	0.013
89	0.0030	0.010	207	0.0035	0.012
101	0.0055	0.018	194	0.0055	0.018
99	0.0040	0.013	206	0.0035	0.012
83	0.0045	0.015			

Note: Coelution is signified by "/ " notation. Coeluting congeners cannot be separated analytically.

Table 7. Summary of laboratory result remark codes applicable to 2000 WCTMP data, and their definitions.

Analyte Category	Code	Definition
Nutrients and Conventionals	A	Value reported is the mean of two or more determinations.
	C	Value calculated from other independent parameters.
	DM	Dilution required due to matrix problems.
	HT	Recommended laboratory holding time was exceeded before analysis.
	INT	Interference encountered during analysis resulted in no obtainable value.
	K	Concentration below the quantification level shown.
	NAV	Requested analysis not available.
	NH	Non-homogenous sample made analysis of a representative sample questionable.
	PI	Possible interference may have affected the accuracy of the laboratory result.
	QC	Quality control problems exist.
	ST	Recommended sample collection/preservation technique not used.
	T	Value reported is less than the quantification level.
	W	Observed result was below the lowest normally reportable value shown.
Base/Neutral Organics, MTBE and BTEX	ND	Observed result was below the quantification level.
Mercury and Trace Metals	BSQC	Batch spike exceeded quality control criteria.
	CCB	Continuing calibration blank exceeded level of detection.
	ELOD	Matrix problem; elevated level of detection reported.
	ISQC	Internal standard exceeded quality control criteria.
	MS	Matrix spike exceeded quality control criteria.
	MSD	Matrix spike duplicate exceeded quality control criteria.
	SLRS	SLRS control exceeded quality control criteria.
PCBs	EST	Estimated value; analyte present above detection limit but not quantified within expected limits of precision.
	FBK	Analyte had measurable value above established QC limit when blank was analyzed using same equipment and analytical method.
	FMS	Failed matrix spike criteria; recovery of matrix spike was outside established quality control limits.
	NAI	Not analyzed due to uncontrollable interference.
	NDD	Not detected due to dilution.

Table 8. WCTMP station sampling history.

Tributary	STORET ID#	1998	1999	2000
AuSable	350061	X		X
Black	740385			X
Boardman*	280014			
Cass	730024			X
Cheboygan	160073			X
Clinton	500233	X		X
Escanaba	210102		X	X
Flint	730285			X
Grand (Lower)	700123		X	X
Grand (Upper)	340025			X
Huron	580364	X		X
Kalamazoo (Lower)	030077		X	X
Kalamazoo (Upper)	390057			X
Manistee	510088			X
Manistique	770073		X	X
Menominee	550038			X
Muskegon (Lower)	610273		X	X
Muskegon (Upper)	670008			X
Ontonagon	660038			X
Pere Marquette	530027		X	X
Pine	490006			X
Raisin	580046	X		X
Rouge	820070	X		X
Saginaw	090177	X		
Shiawassee	730023	X		X
St. Joseph (Lower)	110628		X	X
St. Joseph (Upper)	750273			X
Sturgeon	210032			X
Tahquamenon	170141		X	X
Thunder Bay	040123	X		X
Tittabawassee	730025	X		X

* = Station added to WCTMP in 2001.

Table 9.1 Rule 57 water quality values, mean and range of concentrations, and exceedance rates for mercury and selected trace metal water quality indicators.

STORET ID	Watershed	Mercury (ng/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)
350061	**Au Sable River**				
R.57 Water Quality Value@+		1.300	107.000	13.000	17.000
Mean Concentration+		0.183	0.070	0.225	0.032
Range of Concentrations		0.08 - 0.35	0.01 - 0.11	0.16 - 0.28	0.023 - 0.055
Exceedance Rate*		0 / 6	0 / 6	0 / 6	0 / 6
740385	**Black River (St. Clair Co.)**				
R.57 Water Quality Value@+		1.300	130.000	16.000	21.000
Mean Concentration+		1.983	0.977	2.467	0.740
Range of Concentrations		1.37 - 3.13	0.72 - 1.23	2.03 - 3.24	0.527 - 1
Exceedance Rate*		3 / 3	0 / 3	0 / 3	0 / 3
730024	**Cass River**				
R.57 Water Quality Value@+		1.300	180.000	23.000	33.000
Mean Concentration+		2.297	1.237	2.163	0.855
Range of Concentrations		1.77 - 2.83	0.91 - 1.54	1.91 - 2.32	0.594 - 1.11
Exceedance Rate*		3 / 3	0 / 3	0 / 3	0 / 3
160073	**Cheboygan River**				
R.57 Water Quality Value@+		1.300	110.000	14.000	17.000
Mean Concentration+		0.442	0.122	0.597	0.102
Range of Concentrations		0.14 - 1.43	0.09 - 0.19	0.52 - 0.76	0.025 - 0.408
Exceedance Rate*		1 / 6	0 / 6	0 / 6	0 / 6
500233	**Clinton River**				
R.57 Water Quality Value@+		1.300	170.000	21.000	30.000
Mean Concentration+		5.470	2.100	4.640	2.294
Range of Concentrations		1.47 - 12.26	0.72 - 3.58	2.29 - 6.67	0.653 - 4.17
Exceedance Rate*		6 / 6	0 / 6	0 / 6	0 / 6
210102	**Escanaba River**				
R.57 Water Quality Value@+		1.300	86.000	10.000	13.000
Mean Concentration+		2.742	0.787	1.427	0.170
Range of Concentrations		2.07 - 3.3	0.69 - 0.96	0.96 - 2.33	0.114 - 0.231
Exceedance Rate*		6 / 6	0 / 6	0 / 6	0 / 6
730285	**Flint River**				
R.57 Water Quality Value@+		1.300	150.000	19.000	27.000
Mean Concentration+		3.350	1.450	3.050	2.159
Range of Concentrations		0.76 - 5.36	0.7 - 2.65	2.53 - 3.99	0.698 - 4.31
Exceedance Rate*		2 / 3	0 / 3	0 / 3	0 / 3
700123	**Grand River (Lower)**				
R.57 Water Quality Value@+		1.300	160.000	20.000	29.000
Mean Concentration+		3.570	1.282	2.645	1.650
Range of Concentrations		1.43 - 7.66	0.51 - 2.7	1.67 - 3.82	0.523 - 3.66
Exceedance Rate*		6 / 6	0 / 6	0 / 6	0 / 6

@ = With the exception of mercury, Rule 57 values are expressed as dissolved metal.
+ = Calculated value; not rounded to appropriate number of significant figures.
* = Number of samples exceeding Rule 57 water quality value / number of samples analyzed.

Table 9.2 Rule 57 water quality values, mean and range of concentrations, and exceedance rates for mercury and selected trace metal water quality indicators.

STORET ID	Watershed	Mercury (ng/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)
340025	**Grand River (Upper)**				
R.57 Water Quality Value@+		1.300	170.000	21.000	30.000
Mean Concentration+		3.773	0.993	2.913	1.170
Range of Concentrations		1.3 - 7.14	0.54 - 1.8	2.53 - 3.54	0.593 - 2.07
Exceedance Rate*		2 / 3	0 / 3	0 / 3	0 / 3
580364	**Huron River**				
R.57 Water Quality Value@+		1.300	150.000	19.000	27.000
Mean Concentration+		2.127	0.710	2.503	2.223
Range of Concentrations		1.02 - 2.88	0.55 - 1.01	1.93 - 3.31	2.03 - 2.59
Exceedance Rate*		2 / 3	0 / 3	0 / 3	0 / 3
030077	**Kalamazoo River (Lower)**				
R.57 Water Quality Value@+		1.300	150.000	19.000	27.000
Mean Concentration+		6.090	0.773	1.767	1.484
Range of Concentrations		3.23 - 8.8	0.41 - 1.1	1.31 - 2.35	0.966 - 1.94
Exceedance Rate*		6 / 6	0 / 6	0 / 6	0 / 6
390057	**Kalamazoo River (Upper)**				
R.57 Water Quality Value@+		1.300	160.000	20.000	27.000
Mean Concentration+		4.357	1.247	1.317	1.178
Range of Concentrations		2.38 - 7.23	0.74 - 1.63	0.96 - 1.6	0.693 - 1.69
Exceedance Rate*		3 / 3	0 / 3	0 / 3	0 / 3
510088	**Manistee River**				
R.57 Water Quality Value@+		1.300	108.000	13.000	17.000
Mean Concentration+		0.463	0.223	0.310	0.103
Range of Concentrations		0.28 - 0.63	0.21 - 0.25	0.24 - 0.35	0.072 - 0.126
Exceedance Rate*		0 / 3	0 / 3	0 / 3	0 / 3
770073	**Manistique River**				
R.57 Water Quality Value@+		1.300	77.000	9.300	11.000
Mean Concentration+		1.067	0.267	0.310	0.080
Range of Concentrations		0.78 - 1.52	0.22 - 0.3	0.28 - 0.34	0.064 - 0.091
Exceedance Rate*		1 / 3	0 / 3	0 / 3	0 / 3
550038	**Menominee River**				
R.57 Water Quality Value@+		1.300	84.000	10.000	12.000
Mean Concentration+		3.413	0.350	0.917	0.151
Range of Concentrations		2.01 - 4.64	0.31 - 0.4	0.78 - 1.01	0.134 - 0.179
Exceedance Rate*		3 / 3	0 / 3	0 / 3	0 / 3
610273	**Muskegon River (Lower)**				
R.57 Water Quality Value@+		1.300	120.000	14.000	19.000
Mean Concentration+		0.897	0.170	0.552	0.126
Range of Concentrations		0.37 - 1.37	0.1 - 0.3	0.37 - 0.68	0.077 - 0.223
Exceedance Rate*		1 / 6	0 / 6	0 / 6	0 / 6

@ = With the exception of mercury, Rule 57 values are expressed as dissolved metal.
+ = Calculated value; not rounded to appropriate number of significant figures.
* = Number of samples exceeding Rule 57 water quality value / number of samples analyzed.

Table 9.3 Rule 57 water quality values, mean and range of concentrations, and exceedance rates for mercury and selected trace metal water quality indicators.

STORET ID	Watershed	Mercury (ng/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)
670008	**Muskegon River (Upper)**				
R.57 Water Quality Value@+		1.300	110.000	14.000	18.000
Mean Concentration+		0.663	0.210	0.393	0.112
Range of Concentrations		0.57 - 0.83	0.11 - 0.26	0.34 - 0.48	0.053 - 0.147
Exceedance Rate*		0 / 3	0 / 3	0 / 3	0 / 3
660038	**Ontonagon River**				
R.57 Water Quality Value@+		1.300	59.000	7.000	7.500
Mean Concentration+		1.290	0.700	2.093	0.103
Range of Concentrations		0.64 - 2.21	0.65 - 0.76	1.38 - 2.74	0.085 - 0.134
Exceedance Rate*		1 / 3	0 / 3	0 / 3	0 / 3
530027	**Pere Marquette River**				
R.57 Water Quality Value@+		1.300	110.000	14.000	18.000
Mean Concentration+		1.745	0.422	0.558	0.311
Range of Concentrations		1.25 - 3.28	0.26 - 0.57	0.44 - 0.78	0.14 - 0.482
Exceedance Rate*		4 / 6	0 / 6	0 / 6	0 / 6
490006	**Pine River (Mackinac Co.)**				
R.57 Water Quality Value@+		1.300	74.000	9.000	10.000
Mean Concentration+		1.620	1.443	1.243	0.490
Range of Concentrations		1.43 - 1.87	1.25 - 1.63	1.18 - 1.29	0.42 - 0.543
Exceedance Rate*		3 / 3	0 / 3	0 / 3	0 / 3
580046	**River Raisin**				
R.57 Water Quality Value@+		1.300	160.000	19.000	27.000
Mean Concentration+		3.363	1.153	3.343	1.092
Range of Concentrations		1.4 - 5.68	0.68 - 1.41	2.71 - 4.18	0.776 - 1.34
Exceedance Rate*		3 / 3	0 / 3	0 / 3	0 / 3
820070	**River Rouge**				
R.57 Water Quality Value@+		1.300	96.000	12.000	14.000
Mean Concentration+		6.167	2.293	4.240	3.175
Range of Concentrations		0.96 - 15.2	0.84 - 4.38	1.67 - 7.21	1.11 - 7.09
Exceedance Rate*		5 / 6	0 / 6	0 / 6	0 / 6
730023	**Shiawassee River**				
R.57 Water Quality Value@+		1.300	160.000	20.000	28.000
Mean Concentration+		2.890	1.223	2.157	1.087
Range of Concentrations		0.65 - 5.33	0.44 - 2.7	1.3 - 3.23	0.209 - 2.38
Exceedance Rate*		5 / 6	0 / 6	0 / 6	0 / 6
110628	**St. Joseph River (Lower)**				
R.57 Water Quality Value@+		1.300	150.000	18.000	25.000
Mean Concentration+		2.930	0.430	1.407	0.733
Range of Concentrations		2.16 - 3.43	0.35 - 0.5	1.21 - 1.55	0.589 - 0.882
Exceedance Rate*		3 / 3	0 / 3	0 / 3	0 / 3

@ = With the exception of mercury, Rule 57 values are expressed as dissolved metal.
+ = Calculated value; not rounded to appropriate number of significant figures.
* = Number of samples exceeding Rule 57 water quality value / number of samples analyzed.

Table 9.4 Rule 57 water quality values, mean and range of concentrations, and exceedance rates for mercury and selected trace metal water quality indicators.

STORET ID	Watershed	Mercury (ng/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)
750273	**St. Joseph River (Upper)**				
R.57 Water Quality Value@+		1.300	150.000	18.000	25.000
Mean Concentration+		1.525	0.168	0.552	0.288
Range of Concentrations		0.56 - 2.8	0.04 - 0.34	0.37 - 0.76	0.085 - 0.568
Exceedance Rate*		2 / 6	0 / 6	0 / 6	0 / 6
210032	**Sturgeon River (Delta Co.)**				
R.57 Water Quality Value@+		1.300	89.000	11.000	13.000
Mean Concentration+		1.530	0.350	0.373	0.086
Range of Concentrations		1.11 - 1.88	0.28 - 0.46	0.29 - 0.47	0.036 - 0.167
Exceedance Rate*		2 / 3	0 / 3	0 / 3	0 / 3
170141	**Tahquamenon River**				
R.57 Water Quality Value@+		1.300	67.000	8.100	9.100
Mean Concentration+		1.557	0.297	0.683	0.068
Range of Concentrations		0.66 - 3	0.24 - 0.36	0.26 - 0.95	0.031 - 0.142
Exceedance Rate*		1 / 3	0 / 3	0 / 3	0 / 3
040123	**Thunder Bay River**				
R.57 Water Quality Value@+		1.300	120.000	15.000	20.000
Mean Concentration+		0.463	0.090	0.367	0.091
Range of Concentrations		0.21 - 0.63	0.04 - 0.14	0.26 - 0.51	0.053 - 0.11
Exceedance Rate*		0 / 6	0 / 6	0 / 6	0 / 6
730025	**Tittabawassee River**				
R.57 Water Quality Value@+		1.300	160.000	19.000	27.000
Mean Concentration+		1.567	0.500	1.577	0.331
Range of Concentrations		1.16 - 1.78	0.4 - 0.67	1.44 - 1.69	0.199 - 0.567
Exceedance Rate*		2 / 3	0 / 3	0 / 3	0 / 3

@ = With the exception of mercury, Rule 57 values are expressed as dissolved metal.
+ = Calculated value; not rounded to appropriate number of significant figures.
* = Number of samples exceeding Rule 57 water quality value / number of samples analyzed.

Table 10. 1 Concentrations of total PCB measured in 2000; sampling dates shown. The Rule 57 water quality value for total PCB = 0.026 ng/L.

STORET ID			Total PCB+ (ng/L)
350061		Au Sable River	
	8/22/2000		0.331
740385		Black River (St. Clair Co.)	
	7/26/2000		1.747
730024		Cass River	
	8/15/2000		1.355
160073		Cheboygan River	
	8/1/2000		0.624
500233		Clinton River	
	9/13/2000		8.435
210102		Escanaba River	
	7/25/2000		0.607
730285		Flint River	
	9/6/2000		1.416
700123		Grand River (Lower)	
	10/23/2000		1.065
340025		Grand River (Upper)	
	7/24/2000		1.650
580364		Huron River	
	9/5/2000		3.016
030077		Kalamazoo River (Lower)	
	8/10/2000		17.199
390057		Kalamazoo River (Upper)	
	8/23/2000		6.009
510088		Manistee River	
	8/29/2000		0.978
770073		Manistique River	
	8/17/2000		0.576
550038		Menominee River	
	9/26/2000		0.458
610273		Muskegon River (Lower)	
	8/30/2000		0.804
670008		Muskegon River (Upper)	
	9/25/2000		0.708
660038		Ontonagon River	
	8/15/2000		0.426

+ = Calculated value; not rounded to appropriate number of significant figures.

Table 10. 2 Concentrations of total PCB measured in 2000; sampling dates shown. The Rule 57 water quality value for total PCB = 0.026 ng/L.

STORET ID			Total PCB+ (ng/L)
530027		Pere Marquette River	
	9/26/2000		0.761
490006		Pine River (Mackinac Co.)	
	8/23/2000		0.755
580046		River Raisin	
	8/8/2000		19.525
820070		River Rouge	
	7/27/2000		75.128
730023		Shiawassee River	
	9/12/2000		1.765
110628		St. Joseph River (Lower)	
	8/24/2000		1.828
750273		St. Joseph River (Upper)	
	7/17/2000		1.459
210032		Sturgeon River (Delta Co.)	
	8/29/2000		0.275
170141		Tahquamenon River	
	9/12/2000		0.396
040123		Thunder Bay River	
	8/2/2000		0.761
730025		Tittabawassee River	
	8/14/2000		1.628

+ = Calculated value; not rounded to appropriate number of significant figures.

APPENDIX A

Great Lakes and Environmental Assessment Section Procedure 58
Water Quality Monitoring

Revised
Great Lakes and Environmental Assessment Section
Procedure #58

Water Chemistry Monitoring

This procedure describes the goals and the current structure of the statewide water chemistry monitoring activities. It identifies the sampling locations, sampling frequencies, and the parameters that are analyzed.

Introduction

Environmental monitoring is an essential component of the Michigan Department of Environmental Quality (DEQ) mission. The DEQ recognizes that comprehensive water quality monitoring is necessary to improve natural resource management, maintain sustainable ecosystems, and protect public health. Assessment of the environmental impacts of point and nonpoint source discharges, the latter being diverse and more difficult to measure, is critical. Because bioaccumulative chemicals (e.g., dioxins, polychlorinated biphenyls (PCBs), and mercury) can have serious impacts on aquatic systems when present at extremely low concentrations, monitoring techniques must be sophisticated and sensitive. Therefore, water quality monitoring activities must be expanded and improved to more effectively address changing environmental conditions and issues.

Past limitations in analytical quantification levels, as well as funding reductions, have restricted the overall effectiveness of the DEQ's water monitoring activities. The number of DEQ long-term water quality sites declined from over 100 in the late 1980s to just 13 on the Detroit River and eight on the Saginaw Bay in 1997. This reduction was noted in a 1995 report by the Auditor General, which stated that the Surface Water Quality Division (SWQD) does not have a monitoring program in place to evaluate overall water quality conditions in Michigan. Partly in response to these criticisms, and partly because of a DEQ commitment to develop a comprehensive monitoring plan, a report entitled "A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (Strategy), was completed in January 1997. This Strategy describes the monitoring activities that are necessary for a comprehensive assessment of water quality in Michigan's surface waters. One element of the Strategy is expanded and improved water chemistry monitoring. Recent technological advances (i.e., low-level analytical techniques for metals and organics) now make it possible to collect high-quality water chemistry data at a reasonable cost.

In November 1998, the citizens of Michigan approved the Clean Michigan Initiative, a $675 million bond to clean up, protect, and enhance Michigan's environmental quality, natural resources, and infrastructure. Some of these funds were allocated for the implementation of the Strategy, including the water chemistry monitoring element.

Watershed Management Units

One objective of the enhanced water chemistry monitoring is to be consistent, to the extent possible, with existing DEQ programs and activities. Therefore, the DEQ will continue to use the existing five-year basin units defined by the National Pollutant Discharge Elimination System (NPDES) permitting program. This plan, consistent with the NPDES program, defines 45 watershed units based on drainage to the four Great Lakes (Figure 1). Thirty-one of these units have been selected for placement of water chemistry stations. Monitoring activities within the

watersheds include macroinvertebrate and fish evaluations, water chemistry, fish and wildlife contaminant studies, and sediment chemistry. Integrating the enhanced water chemistry monitoring with the other activities, within the framework of the five-year permitting cycle, will ensure that the monitoring is closely linked with other DEQ programs and contributes to resource management decisions.

Description

The water chemistry monitoring element consists of several components that, in combination, provide data necessary to help achieve the Strategy's four goals:

- Assess the current status and condition of waters of the state and determine whether water standards are being met;
- Measure spatial and temporal water quality trends;
- Evaluate the effectiveness of water quality prevention and protection programs; and
- Identify new and emerging water quality problems.

Some fixed stations are monitored annually to assess spatial and temporal trends, while other stations are monitored at appropriate frequencies to evaluate program effectiveness, address specific issues of interest, or provide information for five-year watershed surveys. Water chemistry monitoring will be fully coordinated with the other elements in the Strategy, especially stream flow, inland lake quality, sediment chemistry, and biological integrity. The basic components of the water chemistry element are described below and are summarized in Appendix 1.

Bays and Connecting Channels

The primary goal for the Bays and Connecting Channel monitoring is to assess spatial and temporal trends. Therefore, these are fixed trend stations that are routinely monitored each year. A second specific goal for the Saginaw Bay monitoring is to determine whether the target phosphorus concentration of 0.015 milligrams per liter (mg/L), as defined in the Saginaw Bay Phosphorus Reduction Strategy, is being met. The connecting channel data, especially on the St. Mary's and Detroit Rivers, also are used to evaluate the effectiveness of Remedial Action Plan activities.

Saginaw Bay and Grand Traverse Bay represent water quality conditions resulting from interactions among land-use, point source and nonpoint sources of pollution, and geological and other natural influences in their respective watersheds. Saginaw Bay represents a largely agricultural, industrial, and urbanized watershed impacted by pesticides, nutrients, suspended solids, and other surface water contaminants typically associated with agriculture and urban runoff. Seven sites on Saginaw Bay are assessed, located at nearshore and offshore areas south of Point AuGres-Sand Point (Figures 2 and 3, Appendix 2). Grand Traverse Bay, on the other hand, represents a minimally impacted watershed that is experiencing increasing development. Four sites on Grand Traverse Bay are monitored, located at a northern and southern point in both the east and west arms (Figures 2 and 4, Appendix 2). Since 1998, the Grand Traverse Bay sites have been sampled three times per year (April, July, and October) for nutrients and conventionals, and once per year (October) for mercury, trace metals, and some organic compounds. From 1998-2000, Saginaw Bay was also sampled three times per year. Starting in 2001, Saginaw Bay samples have been collected from April through November and are analyzed for nutrients, conventionals, mercury, and trace metals.

The Great Lakes Connecting Channels (St. Mary's, St. Clair, and Detroit Rivers) are subject to intense commercial and industrial activity. These waters represent large watersheds also affected by interactions among land-use, point and nonpoint pollution sources, and geological and other natural influences. They serve as conduits for water quality impacts between the Great Lakes. A considerable amount of historical water chemistry data has been collected on the Detroit River, whereas relatively little historical data exist for the St. Mary's and St. Clair Rivers. The current sampling design was initiated in 1998. Six sites, consisting of the headwaters and mouth of the St. Mary's, St. Clair, and Detroit Rivers (Figure 2, Appendix 2), are monitored every year. The sites are sampled monthly during ice-free time periods (usually April through November). All samples are analyzed for mercury, trace metals, nutrients, and conventional parameters. At least one sample per year from each site is analyzed for PCB congeners and selected organics, such as base/neutrals and volatile organic compounds.

Intensive Sites

Like the Bays and Connecting Channels, intensive sites are part of the fixed station trend network and are routinely monitored each year. The primary goal for the intensive locations is to assess spatial and temporal trends. The data are also used to calculate chemical loadings from these rivers to the Great Lakes.

Beginning in the year 2000, six sites were designated as intensive sites. Intensive sites are sampled 12 times per year on a flow-stratified schedule, with approximately three-quarters of the samples collected during high-flow. High-flow is defined as one of the following: greater than 20 percent exceedance flow; an increase in stream flow of 100 percent above the preceding base flow condition; or an increase in stream flow following a long period of discharge at base flow and considered likely to produce a measurable change in the concentration of sampled parameters. These locations include the Au Sable, Clinton, Grand, Kalamazoo, Muskegon, and Saginaw Rivers (Figure 5, Appendix 2). The Saginaw River was not sampled in 2000, due to the extensive sediment remediation that took place there. It was first sampled in 2001. Intensive sites were selected based on large flow volumes and/or expected contaminant loads to the Great Lakes, except for the Au Sable River, which was chosen as a high-quality, background river. Data on contaminant concentrations and flow are collected from each river for loading calculations. For temporal trend analysis, measured loads are calculated using flow-normalized concentrations, to account for variation that may be due strictly to precipitation changes from year to year. All samples are analyzed for mercury, trace metals, nutrients, and conventional parameters. At least one sample per year from each intensive site is analyzed for PCB congeners and selected organic chemicals, such as base/neutrals and volatile organic compounds.

Integrator Sites

The integrator sites are also a part of the fixed station trend network and are monitored each year. The primary goal for the integrator locations is to assess spatial and temporal trends. Once every five years, the data from each integrator site are used to calculate chemical loadings.

The 25 integrator sites represent water quality conditions of major streams and rivers in large, heterogeneous basins (Figure 6, Appendix 2). Integrator sites generally are located near the outlet of large basins at or near flow gauging stations. Four integrator sites are located in the mid-reaches of the largest watersheds, including the St. Joe, Kalamazoo, Grand, and Muskegon Rivers. Integrator sites are sampled intensively on a staggered five-year rotation. Once every five years (consistent with the NPDES program), each integrator site is sampled 12 times on a

flow-stratified schedule identical to the intensive sites described above. Contaminant loads are calculated for these years. During the other four years in the five-year cycle, the integrator sites are sampled four times per year. These samples are prescheduled throughout the period from ice breakup to ice cover and may include samples during spring snowmelt and low flow. Trends are evaluated on the combined data sets. All samples are analyzed for mercury, trace metals, nutrients, and conventional parameters. At least one sample per year from each integrator site is analyzed for PCB congeners and selected organic chemicals, such as base/neutrals and volatile organic compounds.

Issue Sites

Issue sites are chosen by the DEQ and the United States Geological Survey (USGS) to understand how specific activities or conditions affect water quality. Issue sites are a flexible component of the water chemistry program element that focuses on known or suspected problems, as well as emerging issues. There are no fixed station issue sites. Each year, the DEQ and the USGS prioritize data needs and choose issue sites accordingly. While data requirements focus on the NPDES-targeted basins, these sites may be anywhere in the state. Issue sites may be chosen to collect data prior to and after a nonpoint source project, assess the effects of land use on water quality, evaluate the impacts of pesticides and herbicides, and/or collect data on an emerging issue. Sites monitored for the development of Total Maximum Daily Loads (TMDLs) fall into this category. Depending upon the rationale for monitoring, an issue site may be monitored for one or a few years or perhaps for a longer time period. The suite of parameters collected at each indicator site varies based upon the issue being addressed. Current examples of issues that are being investigated include mercury levels in lakes and rivers/streams in Michigan and the effect of the Conservation Reserve Enhancement Program on water quality. Emerging chemicals of concern have been monitored at several locations, including methyl tert-butyl ether (MTBE; a gasoline additive) and perfluorooctane sulfonate (PFOS; used in ScothGard). In addition, extensive PCB monitoring will be conducted in selected watersheds to support future TMDL development efforts.

Minimally Impacted Sites

One minimally impacted site is located in each of the 31 watershed management units with an intensive or integrator station (Appendix 2). These sites are sampled once every five years, consistent with the NPDES five-year rotating basin schedule, to provide data on the best water quality that can be expected in each watershed. This information allows for a comparison of water chemistry data collected at other locations in a watershed to the minimally impacted site. It should be noted that the term "minimally impacted" varies by watershed. A minimally impacted site in the Rouge River Watershed differs from a minimally impacted site in the Au Sable River Watershed. These locations are sampled four times during the year for mercury, trace metals, conventionals, nutrients, and selected organic compounds.

Five-Year Basin Sampling

The SWQD biologists routinely collect water samples each year from many biological survey locations, as part of the five-year rotating basin assessments. These generally are one-time grab samples, and the parameters of interest most often include nutrients and conventional parameters. A small subset of these samples is analyzed for chemicals, such as metals and/or a variety of organic contaminants, as local conditions warrant. Samples are collected from sites identified by the biologists, and if appropriate several samples are collected during the year by the SWQD or consultants.

Grants to Local Governments

Starting in 2001, the DEQ makes grants available to local governments for water quality monitoring. These entities submit proposals that are evaluated by the DEQ. Proposals are selected based on defined criteria, including watershed priority, the parameter/issue(s) being addressed, cost, and amount of local match. We expect that these projects will produce data for many areas of the state.

One example of such a project is Lake St. Clair and its watershed. Monitoring for bacteria, nutrients, and metals in the Lake St. Clair Watershed is a priority for the Macomb County Health Department (County) and the DEQ to identify contaminant sources, particularly sanitary sewer overflows, combined sewer overflows, and illicit connections. The DEQ provided grants to the County in 1998 and 2000 for water quality monitoring. The County has monitored a number of locations in the Clinton River and Lake St. Clair (nearshore and open water) in 1998-2001. Additional testing will be conducted in areas not attaining water quality standards due to exceedences of *Escherichia coli*. These efforts will be linked with TMDL requirements. A number of waterbodies in Macomb County are not attaining standards due to high bacteria levels and associated beach closings. The development and implementation of TMDLs will require extensive monitoring of these waters and control measures to reduce pollutant inputs.

Other Sites

Samples are also taken at selected locations that are sampled for other elements of the monitoring strategy, including inland lake sediments, fish contaminants, and biological trends. The locations vary each year, and the parameter list varies on a site-specific basis.

Parameters

Data on nutrients (phosphorus, nitrogen, and ions) and conventional parameters (temperature, conductivity, suspended solids, pH, and dissolved oxygen) will be collected from all of the sites identified above. These are basic measures of water quality, and the DEQ and the USGS frequently receive requests for such information. In addition, these analyses are relatively inexpensive.

Total mercury and trace metals (cadmium, chromium, copper, lead, nickel, and zinc) will also be measured at most of the sites, except perhaps at some of the issue sites that are specifically chosen for other reasons. Samples will not routinely be analyzed for dissolved metals, given that such analysis adds additional expense and that sample collection for dissolved metals is more time-consuming. The DEQ recently completed a project establishing ratios of total and dissolved metals in several Michigan rivers. This information can be used to convert total metal concentrations to dissolved concentrations if necessary. In addition, if data for total metals concentrations indicate possible exceedance of water quality standards, then follow-up sampling using dissolved techniques can be conducted.

Each year, at least one sample from the connecting channels, intensive sites, integrator sites, and minimally impacted sites are collected and analyzed for PCBs using state-of-the-art techniques. More frequent PCB samples are collected as needed at some locations. Extensive sampling in 1998 and 1999 for other organics, such as base neutrals and methyl-tertiary-butyl ether, from several rivers were almost all below detection. Therefore, only one sample per year from each location is analyzed for these substances as a spot check. Pesticide/herbicide analyses may be conducted at selected sites, most likely at issue sites.

Data are reviewed each year to determine whether additional parameters should be added, removed, or analyzed at a greater or lesser frequency. An intricate part of the water chemistry monitoring element is the development and use of indicators to reduce cost. To identify statistically valid indicators, historical and new data will be examined. If feasible, lower cost indicator parameters will be substituted in future sampling.

Data Management and Reporting

Data management and reporting are integral parts of the water chemistry monitoring element. All water chemistry data will be entered into the Storage and Retrieval System database. Data from the Bays and Connecting Channels are compiled into an annual trend report, as are the data from the intensive, integrator, and minimally impacted sites. The information from the issue sites are summarized in individual reports as appropriate. Data collected as part of the five-year basin sampling are summarized in Great Lakes and Environmental Assessment Section biosurvey reports. Data collected as part of TMDL sampling are summarized in individual reports prepared for each waterbody for which TMDLs are developed. The data also are used in preparation of the state's Section 305(b) report. Each local government that receives a grant for water quality monitoring is required to produce a final report at the conclusion of the project.

Approved: James Grant Date: 5/1/02

APPENDIX 1
Water Chemistry Monitoring Components

Bays

Saginaw Bay (seven locations)
Grand Traverse Bay (four locations)

These stations were sampled three times per year (April, July, and October) from 1998-2000. This continues at Grand Traverse Bay. Monthly samples have been collected from Saginaw Bay since 2001.

Connecting Channels

St. Mary's River (upstream and downstream)
St. Clair River (upstream and downstream)
Detroit River (upstream and downstream)

These stations are sampled monthly during the open water portion of each year.

Intensive Sites

AuSable River
Clinton River
Grand River
Kalamazoo River
Muskegon River
Saginaw River

Stations are sampled near their mouths 12 times annually, on a flow-stratified schedule to calculate loads.

Integrator Sites

Ontonagon River	Muskegon River (upper)	Cass River
Sturgeon River	Grand River (upper)	Flint River
Tahquamenon River	Kalamazoo River	Shiawassee River
Menominee River	St. Joe River (upper/lower)	Tittabawassee River
Escanaba River	Raisin River	Thunder Bay River
Manistique River	Huron River	Cheboygan River
Pine River (Mackinac County)	Rouge River	Manistee River
Pere Marquette River	Black River (St. Clair County)	Boardman River

Each site is sampled 12 times per year once in a five-year cycle (during its basin year). In the other four years, a site is sampled four times per year.

Issue Sites

Sites and sampling frequency are determined each year.

Minimally Impacted Sites

Bigelow Creek (Muskegon River; 2001)
Evergreen Creek (Cass River; 2001)
Grand River (Grand River; 2001)
Pokagon Creek (Lower St. Joe River; 2001)
Tioga River (Sturgeon River; 2001)
Huron River (Huron River; 2002)
Perry Creek (Au Sable River; 2002)
Paint River (Menominee River; 2002)
West Branch Tittabawassee River (Tittabawassee River; 2002)

Minimally impacted sites for the 2003 to 2005 intensive and integrator watersheds will be selected prior to each field season.

Stations will be sampled four times per year.

Five-Year Basin

Locations and sampling frequency are identified each year in the target watersheds (consistent with the five-year basin cycle).

APPENDIX 2

Figure 1. Five-Year Watershed Assessment Cycle

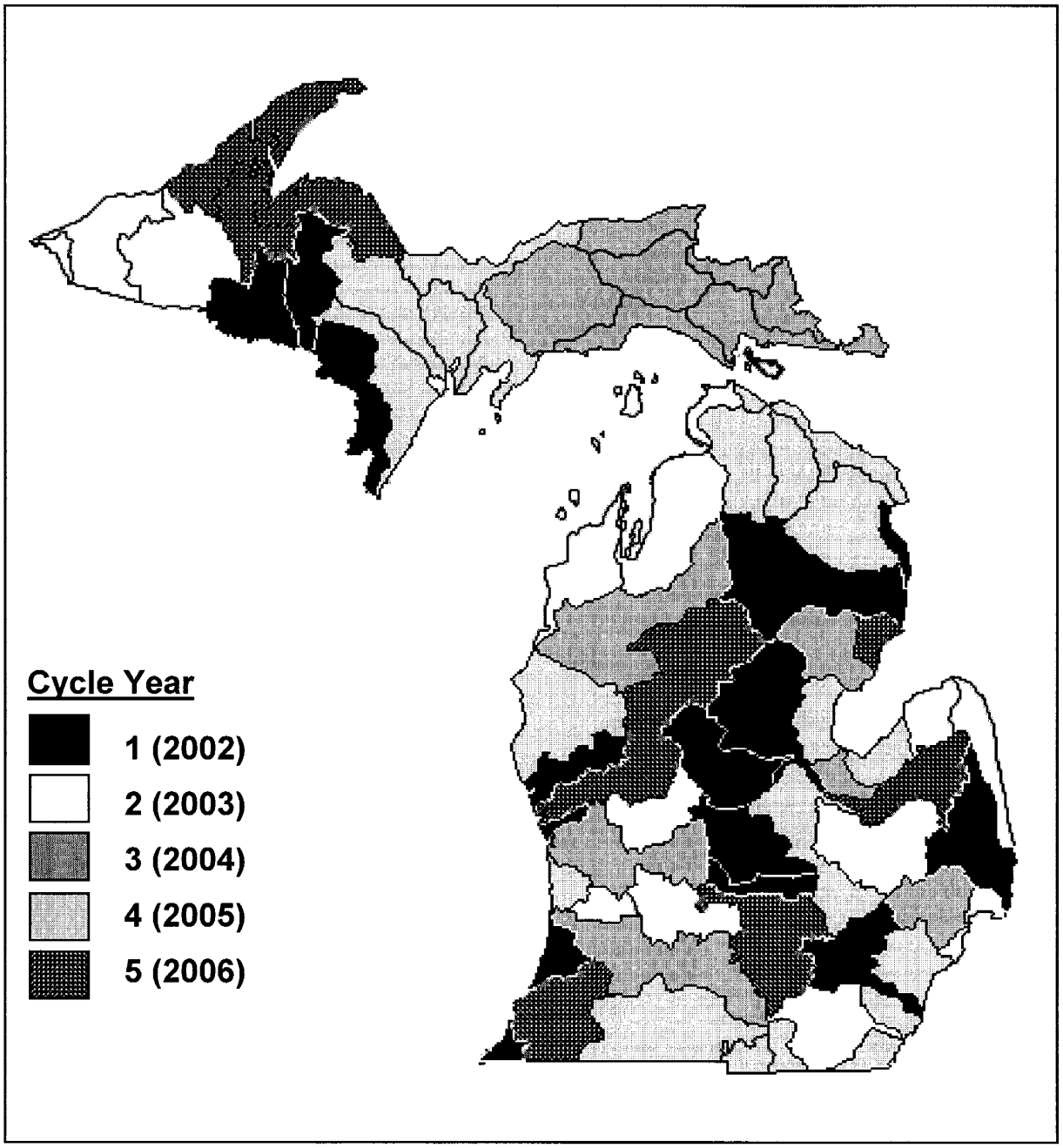

Figure 2. Water chemistry trend monitoring locations on Saginaw Bay, Grand Traverse Bay, and the three Great Lakes Connecting Channels.

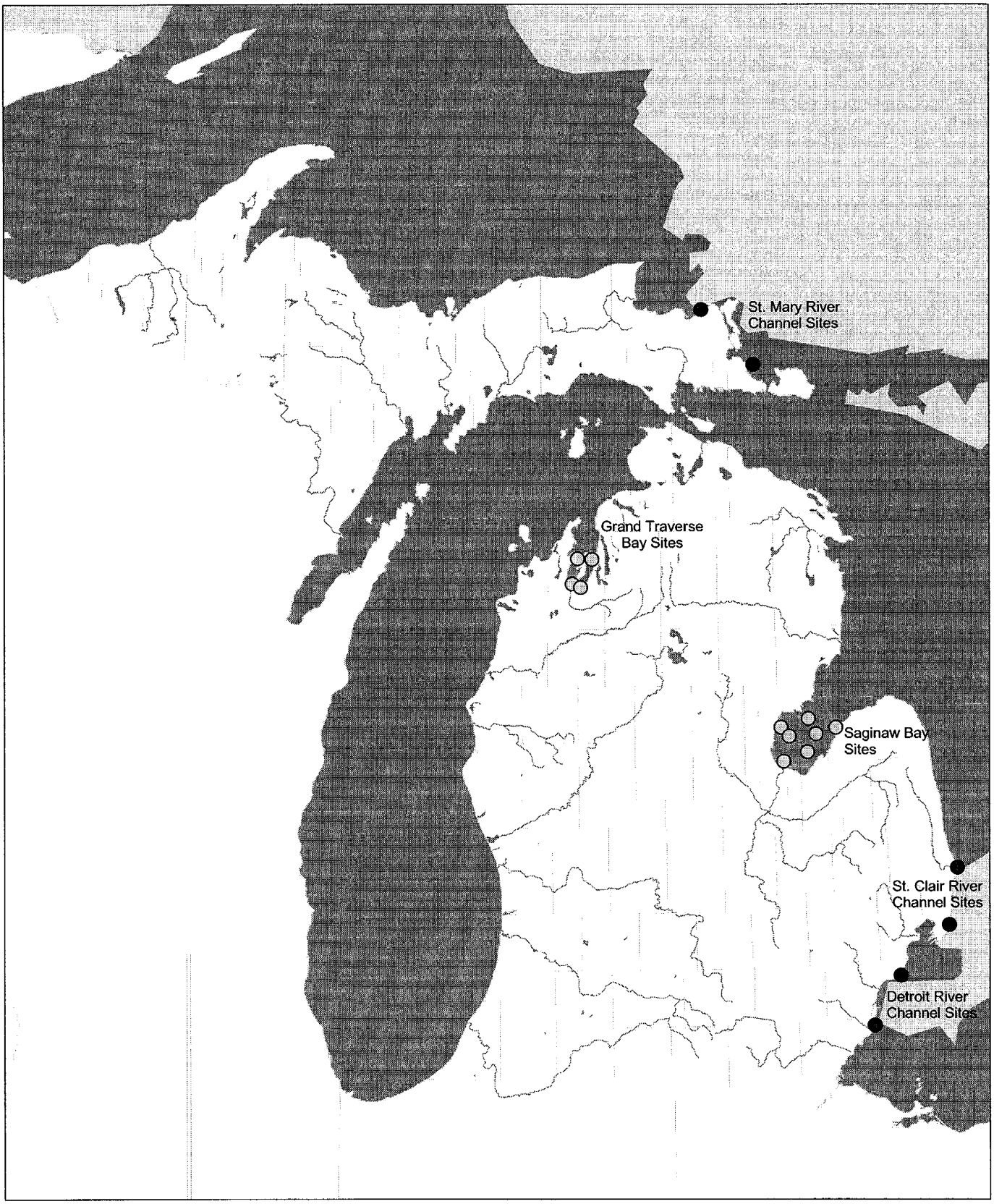

Figure 3. Water chemistry trend monitoring locations on Saginaw Bay.

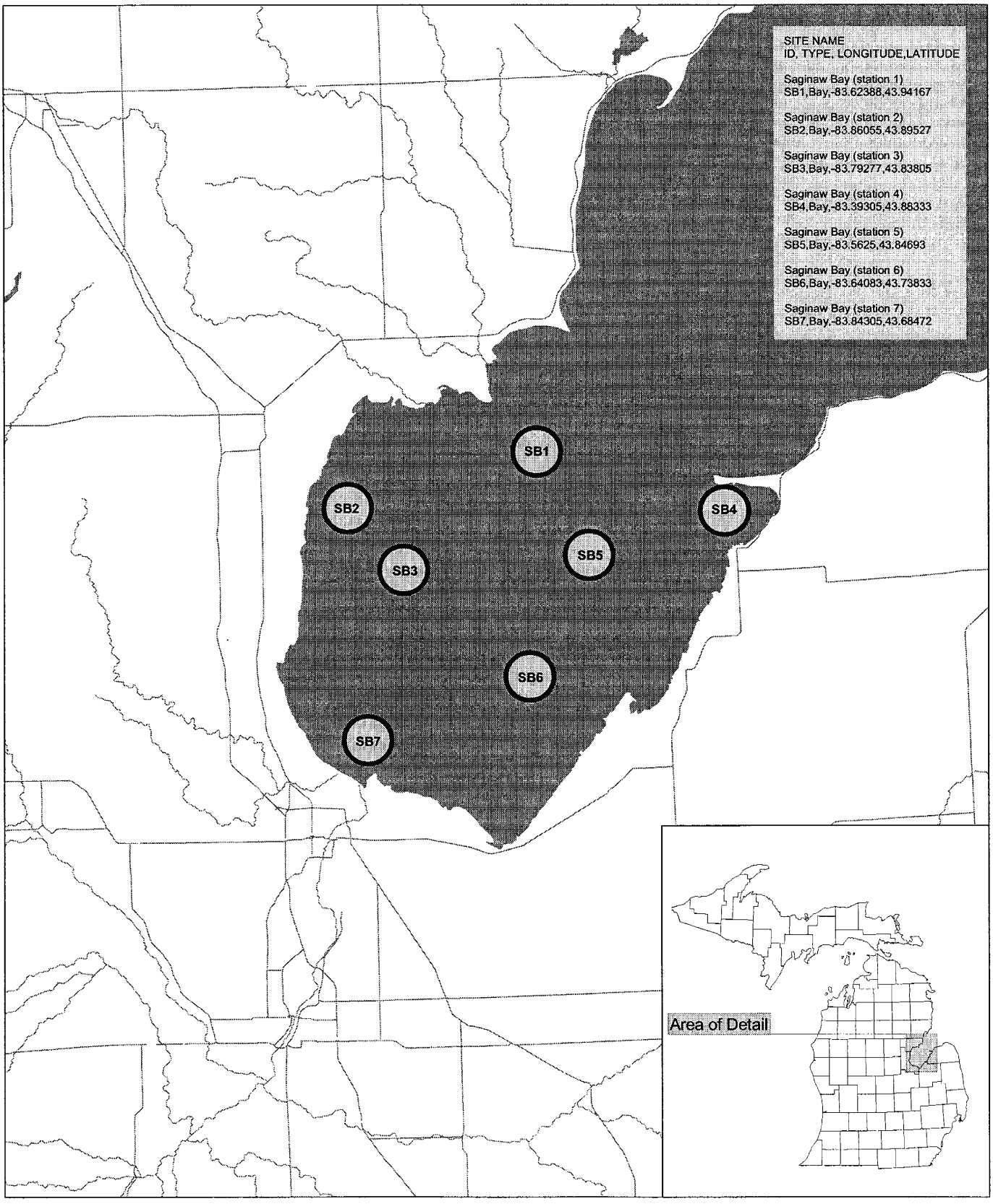

Figure 4. Water chemistry trend monitoring locations on Grand Traverse Bay.

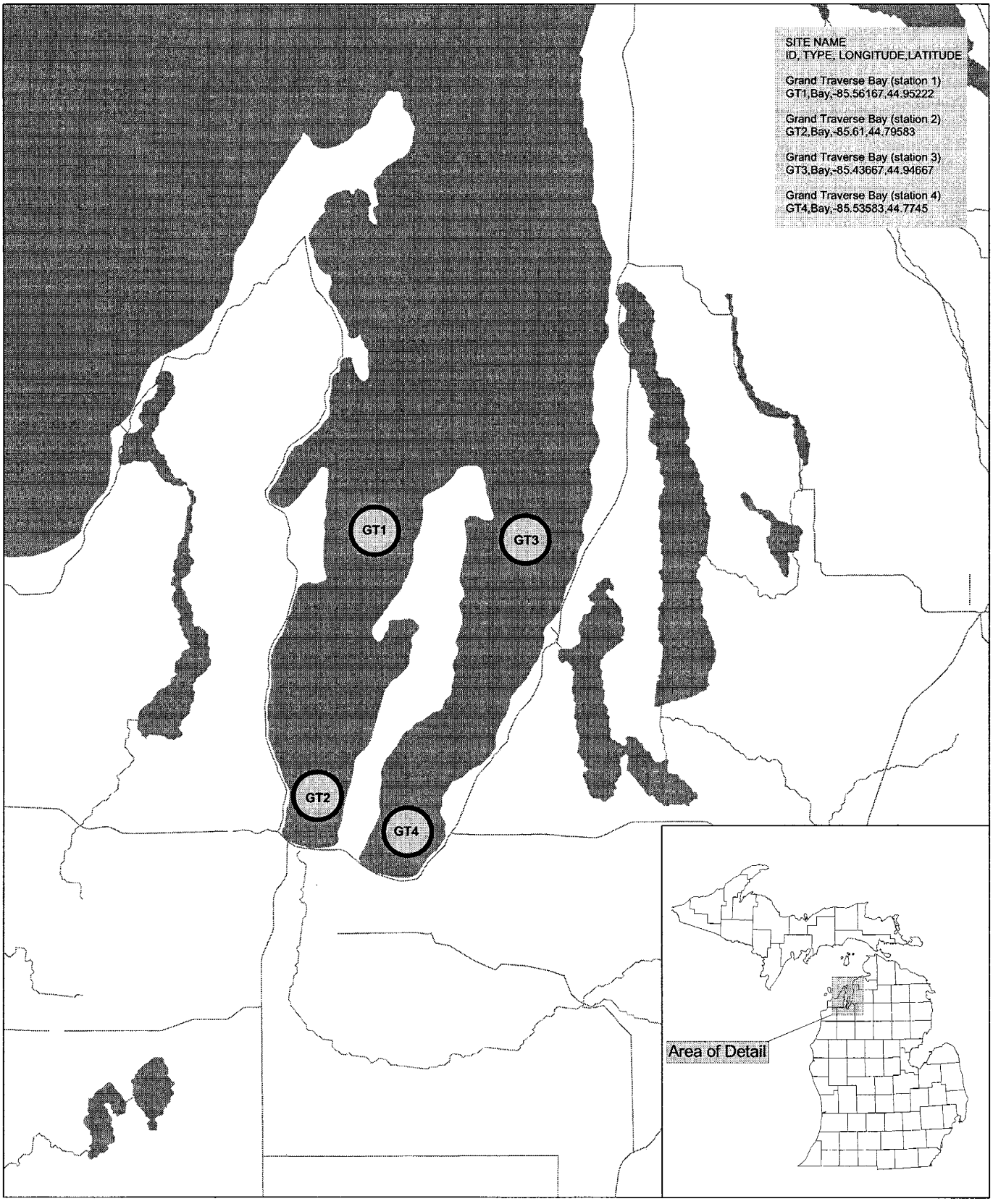

Figure 5. Intensive water chemistry trend monitoring locations and associated watersheds.

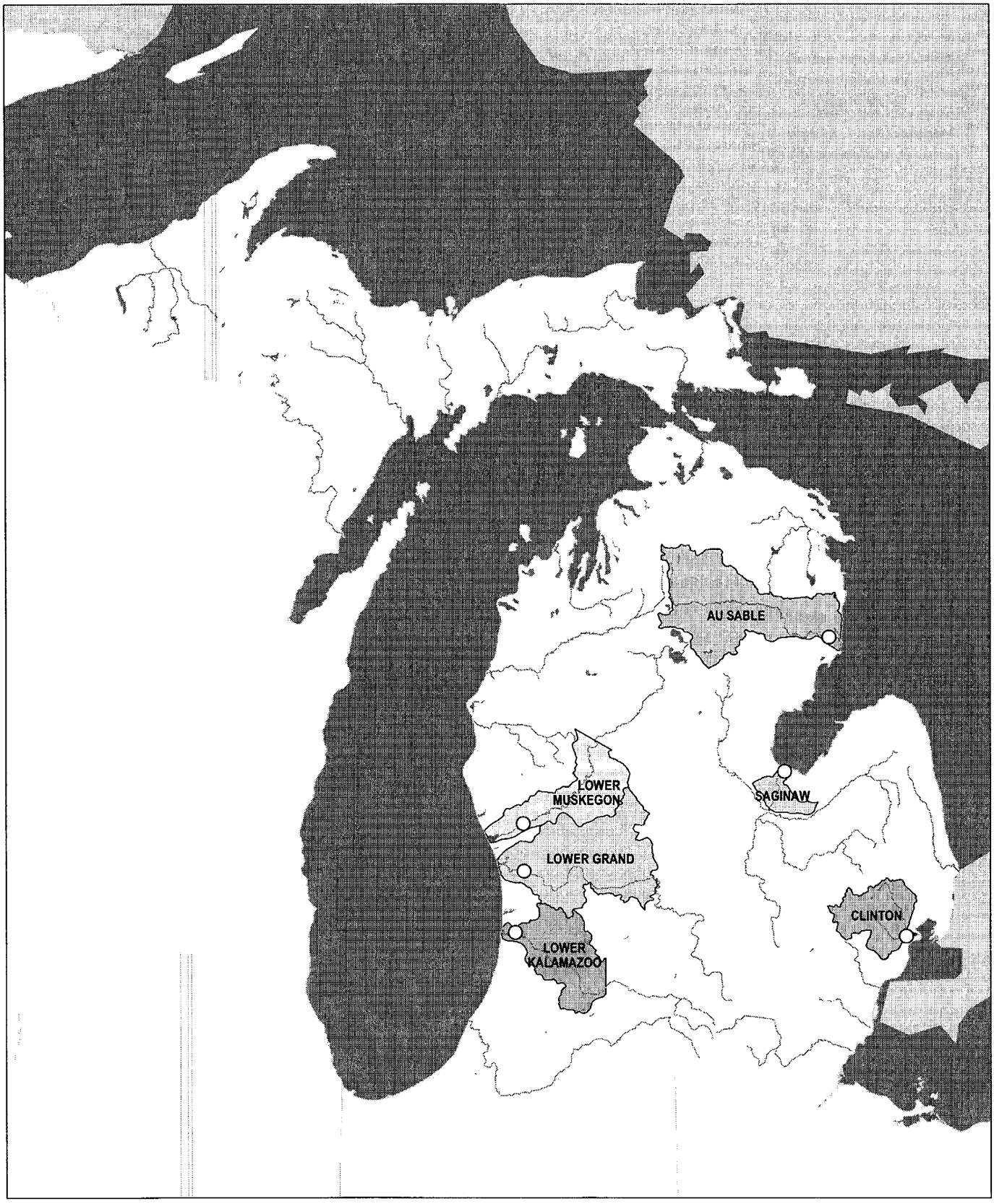

Figure 6. Integrator water chemistry trend monitoring locations and associated watersheds.

APPENDIX B

Water Chemistry Data Summarized in the 2000 Report

STORET ID	Ammonia (mg N/L)	Nitrate (mg N/L)	Nitrite (mg N/L)	Kjeldahl Nitrogen (mg N/L)	Phosphorus (mg P/L)	Ortho Phosphate (mg P/L)	Sulfate (mg/L)	Chloride (mg/L)	Organic Carbon (mg/L)	Dissolved Solids (mg/L)
350061 Au Sable River										
7/12/2000	0.02	C 0.01	T 0.00	0.25	0.01	T 0.00	4.00	6.00	5.80	192.0
8/2/2000	0.02	C T 0.01	0.00	0.25	0.01	0.01	6.00	5.00	4.40	190.0
8/22/2000	HT 0.02	C HT 0.02	0.00	0.25	0.02	0.01	6.00	5.00	3.40	190.0
9/19/2000	HT 0.02	C HT 0.02	0.00	HT 0.20	HT 0.01	0.01	6.00	5.00	2.90	200.0
10/18/2000	HT 0.01	C HT 0.02	T 0.00	HT 0.13	HT 0.01	HT 0.01	8.00	6.00	2.30	200.0
11/28/2000	0.02	C 0.02	0.00	0.14	0.01	HT 0.01	6.00	6.00	2.10	210.0
No. of Samples:	6	6	6	6	6	6	6	6	6	6
Mean+:	0.02	0.02	0.00	0.20	0.01	0.01	6.00	5.50	3.48	197.0
Median+:	0.02	0.02	0.00	0.23	0.01	0.01	6.00	5.50	3.15	196.0
740385 Black River (St. Clair Co.)										
7/26/2000	0.06	C HT 0.34	HT 0.00	0.42	0.04	HT 0.01	25.00	18.00	3.10	228.0
8/16/2000	HT 0.06	C HT 1.35	HT 0.02	0.76	0.08	HT 0.02	46.00	27.00	7.40	310.0
9/18/2000	HT 0.03	C HT 0.21	0.00	0.44	0.04	0.01	49.00	35.00	5.00	340.0
No. of Samples:	3	3	3	3	3	3	3	3	3	3
Mean+:	0.05	0.63	0.01	0.54	0.05	0.01	40.00	26.67	5.17	292.7
Median+:	0.06	0.34	0.00	0.44	0.04	0.01	46.00	27.00	5.00	310.0
730024 Cass River										
7/19/2000	0.02	C 1.38	0.02	1.14	0.10	HT 0.01	70.00	50.00	8.80	482.0
8/15/2000	HT 0.02	C HT 2.10	HT 0.01	1.09	0.09	HT 0.01	63.00	39.00	10.00	450.0
9/12/2000	HT 0.07	C HT 0.91	0.01	HT 0.93	HT 0.12	0.04	57.00	45.00	8.20	440.0
No. of Samples:	3	3	3	3	3	3	3	3	3	3
Mean+:	0.04	1.46	0.01	1.05	0.10	0.02	63.33	44.67	9.00	457.3
Median+:	0.02	1.38	0.01	1.09	0.10	0.01	63.00	45.00	8.80	450.0

+ = Calculated value; not rounded to the appropriate number of significant figures.
# = Median includes a concentration below quantification, which was assigned a value equal to the quantification level.
* = Mean includes concentrations below quantification, which were assigned a value equal to 1/2 the quantification level.
A = Value reported is the mean of two or more determinations.
C = Value calculated from other independent parameters.
DM = Dilution required due to matrix problems.
HT = Recommended laboratory holding time was exceeded before analysis.
INT = Interference encountered during analysis resulted in no obtainable value.
K = Concentration below the quantification level shown.
NAV = Requested analysis not available.
NH = Non-homogenous sample made analysis of a representative sample questionable.
PI = Possible interference may have affected the accuracy of the laboratory result.
QC = Quality control problems exist.
ST = Recommended sample collection/preservation technique not used.
T = Value reported is less than the quantification level.
W = Observed result was below the lowest normally reportable value shown.

STORET ID	Ammonia (mg N/L)	Nitrate (mg N/L)	Nitrite (mg N/L)	Kjeldahl Nitrogen (mg N/L)	Phosphorus (mg P/L)	Ortho Phosphate (mg P/L)	Sulfate (mg/L)	Chloride (mg/L)	Organic Carbon (mg/L)	Dissolved Solids (mg/L)
160073 Cheboygan River										
7/11/2000	T 0.01	C T 0.01	T 0.00	0.28	0.01	0.01	7.00	7.00	4.30	203.0
8/1/2000	0.02	0.02	T 0.00	0.22	0.01	0.00	7.00	7.00	4.20	200.0
8/10/2000	0.02	C 0.03	T 0.00	0.26	0.01	0.00	6.00	7.00	3.80	200.0
8/21/2000	HT 0.02	C T 0.01	T 0.00	0.35	0.02	0.00	8.00	6.00	4.20	200.0
9/18/2000	HT 0.02	C HT 0.02	T 0.00	HT 0.23	HT 0.01	T 0.00	9.00	7.00	3.60	210.0
11/27/2000	0.02	C 0.04	0.00	0.22	T 0.00	HT 0.00	8.00	7.00	3.80	210.0
No. of Samples:	6	6	6	6	6	6	6	6	6	6
Mean+:	0.02	0.02	0.00	0.26	0.01	0.00	7.50	6.83	3.98	203.8
Median+:	0.02	0.02	0.00	0.25	0.01	0.00	7.50	7.00	4.00	201.5
500233 Clinton River										
7/20/2000	0.06	C 1.87	0.03	0.81	0.13	HT 0.07	41.00	146.00	6.30	625.0
7/31/2000	0.08	C 0.87	0.04	1.06	0.23	0.13	18.00	40.00	10.00	260.0
8/3/2000	0.15	C 1.04	0.05	1.32	0.24	0.15	20.00	54.00	10.00	320.0
8/30/2000	HT 0.05	C HT 1.45	0.02	0.75	0.12	0.07	36.00	138.00	5.90	590.0
9/13/2000	HT 0.11	C HT 0.76	0.03	HT 1.10	HT 0.19	0.07	23.00	67.00	DM 10.00	360.0
11/28/2000	0.09	C 1.50	0.02	0.71	0.09	HT 0.05	36.00	127.00	7.30	570.0
No. of Samples:	6	6	6	6	6	6	6	6	6	6
Mean+:	0.09	1.25	0.03	0.96	0.17	0.09	29.00	95.33	8.25	454.2
Median+:	0.09	1.25	0.03	0.94	0.16	0.07	29.50	97.00	8.65	465.0

+ = Calculated value; not rounded to the appropriate number of significant figures.
# = Median includes a concentration below quantification, which was assigned a value equal to the quantification level.
* = Mean includes concentrations below quantification, which were assigned a value equal to 1/2 the quantification level.
A = Value reported is the mean of two or more determinations.
C = Value calculated from other independent parameters.
DM = Dilution required due to matrix problems.
HT = Recommended laboratory holding time was exceeded before analysis.
INT = Interference encountered during analysis resulted in no obtainable value.
K = Concentration below the quantification level shown.
NAV = Requested analysis not available.
NH = Non-homogenous sample made analysis of a representative sample questionable.
PI = Possible interference may have affected the accuracy of the laboratory result.
QC = Quality control problems exist.
ST = Recommended sample collection/preservation technique not used.
T = Value reported is less than the quantification level.
W = Observed result was below the lowest normally reportable value shown.

STORET ID		Ammonia (mg N/L)		Nitrate (mg N/L)		Nitrite (mg N/L)	Kjeldahl Nitrogen (mg N/L)		Phosphorus (mg P/L)		Ortho Phosphate (mg P/L)		Sulfate (mg/L)	Chloride (mg/L)		Organic Carbon (mg/L)	Dissolved Solids (mg/L)
210102	Escanaba River																
	7/25/2000		0.06	C	0.15	0.02		0.59		0.15		0.12	53.00	47.00		23.00	371.0
	8/7/2000		0.06	C	0.16	0.02		0.54		0.19		0.15	46.00	45.00		20.00	350.0
	8/28/2000	HT	0.11	C HT	0.19	0.03		0.71		0.14		0.10	90.00	61.00		27.00	460.0
	9/25/2000	HT	0.07	C HT	0.10	0.01	HT	0.77	HT	0.09		0.06	43.00	40.00	DM	32.00	310.0
	10/16/2000	HT	0.05	C HT	0.08	0.01	HT	0.52	HT	0.06		0.03	30.00	22.00		16.00	230.0
	11/29/2000		0.06	C	0.16	0.01		0.60		0.10	HT	0.06	40.00	32.00		20.00	280.0
	No. of Samples:		6		6	6		6		6		6	6	6		6	6
	Mean+:		0.07		0.14	0.02		0.62		0.12		0.09	50.33	41.17		23.00	333.5
	Median+:		0.06		0.16	0.02		0.60		0.12		0.08	44.50	42.50		21.50	330.0
730285	Flint River																
	8/22/2000	HT	0.04	C HT	2.40	0.01		0.91		0.11		0.06	40.00	82.00		8.50	470.0
	9/6/2000	K	0.05	C HT	3.90	0.02		1.01		0.15		0.07	44.00	100.00		8.30	520.0
	9/28/2000	HT	0.06	C HT	1.33	0.01	HT	1.17	HT	0.18		0.04	34.00	54.00		9.10	370.0
	No. of Samples:		3		3	3		3		3		3	3	3		3	3
	Mean+:	*	0.04		2.54	0.01		1.03		0.15		0.06	39.33	78.67		8.63	453.3
	Median+:	K	0.05		2.40	0.01		1.01		0.15		0.06	40.00	82.00		8.50	470.0
700123	Grand River (Lower)																
	7/11/2000		0.01	C	2.10	0.03		0.95		0.15	HT	0.04	36.00	50.00		7.30	405.0
	8/1/2000		0.02		1.01	0.03		1.07		0.11		0.02	41.00	42.00		5.80	380.0
	8/31/2000	HT	0.02	C HT	0.84	0.04		1.33		0.13	INT		47.00	58.00		7.30	420.0
	9/26/2000	HT	0.11	C HT	2.40	0.03	HT	1.24	HT	0.26		0.08	31.00	31.00		7.70	310.0
	10/23/2000		0.08	C	1.65	0.02		0.76		0.08	HT	0.02	56.00	55.00		6.90	470.0
	11/14/2000		0.16	C	1.82	0.03		0.77		0.07		0.04	43.00	44.00		6.80	420.0
	No. of Samples:		6		6	6		6		6		5	6	6		6	6
	Mean+:		0.07		1.64	0.03		1.02		0.13		0.04	42.33	46.67		6.97	400.8
	Median+:		0.05		1.74	0.03		1.01		0.12		0.04	42.00	47.00		7.10	412.5

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340025	Grand River (Upper)										
	7/24/2000	0.01	C 1.50	0.01	0.99	0.11	HT 0.02	48.00	44.00	10.00	443.0
	9/7/2000	HT 0.02	C HT 1.28	0.01	0.75	0.11	0.06	48.00	53.00	8.00	460.0
	9/26/2000	HT 0.08	C HT 3.80	0.03	HT 1.23	HT 0.24	0.09	34.00	29.00	8.80	320.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.04	2.19	0.02	0.99	0.15	0.06	43.33	42.00	8.93	407.7
	Median+:	0.02	1.50	0.01	0.99	0.11	0.06	48.00	44.00	8.80	443.0
580364	Huron River										
	7/20/2000	0.07	C 0.55	0.03	0.80	0.06	HT 0.02	34.00	69.00	8.10	423.0
	8/9/2000	0.08	C HT 0.41	HT 0.02	0.95	0.09	HT 0.02	52.00	80.00	9.00	460.0
	9/5/2000	HT 0.05	C HT 0.35	HT 0.01	0.78	0.06	HT 0.02	32.00	73.00	8.70	420.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.07	0.44	0.02	0.84	0.07	0.02	39.33	74.00	8.60	434.3
	Median+:	0.07	0.41	0.02	0.80	0.06	0.02	34.00	73.00	8.70	423.0
030077	Kalamazoo River (Lower)										
	7/11/2000	0.07	C 1.63	0.03	0.90	0.10	HT 0.03	30.00	36.00	7.20	380.0
	8/1/2000	0.04	0.81	0.02	0.93	0.10	0.01	41.00	47.00	5.00	400.0
	8/10/2000	0.02	C 0.95	0.02	0.94	0.11	0.02	41.00	42.00	6.90	380.0
	9/7/2000	HT 0.01	C HT 0.74	0.02	0.88	0.08	0.00	36.00	47.00	5.50	400.0
	9/26/2000	HT 0.05	C HT 1.90	0.03	HT 0.96	HT 0.19	0.08	32.00	28.00	7.90	290.0
	11/15/2000	0.09	C 1.45	0.01	0.62	0.06	0.06	42.00	44.00	5.80	420.0
	No. of Samples:	6	6	6	6	6	6	6	6	6	6
	Mean+:	0.05	1.25	0.02	0.87	0.11	0.03	37.00	40.67	6.38	378.3
	Median+:	0.05	1.20	0.02	0.92	0.10	0.03	38.50	43.00	6.35	390.0

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390057	Kalamazoo River (Upper)										
	7/18/2000	0.02	C 1.02	0.01	0.58	0.07	0.03	43.00	44.00	6.00	434.0
	8/23/2000	HT 0.04	C HT 0.92	0.01	0.65	0.09	0.03	36.00	48.00	5.30	430.0
	9/21/2000	HT 0.03	C HT 0.99	HT 0.01	HT 0.54	HT 0.05	HT 0.02	35.00	41.00	6.00	420.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.03	0.98	0.01	0.59	0.07	0.03	38.00	44.33	5.77	428.0
	Median+:	0.03	0.99	0.01	0.58	0.07	0.03	36.00	44.00	6.00	430.0
510088	Manistee River										
	7/25/2000	T 0.01	C 0.11	0.01	0.80	0.02	0.01	9.00	10.00	2.60	224.0
	8/29/2000	HT 0.02	C HT 0.12	0.00	0.26	0.02	0.01	9.00	11.00	2.70	220.0
	9/25/2000	HT 0.03	C HT 0.14	0.00	HT 0.18	HT 0.02	0.01	10.00	12.00	2.50	230.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.02	0.12	0.00	0.41	0.02	0.01	9.33	11.00	2.60	224.7
	Median+:	0.02	0.12	0.00	0.26	0.02	0.01	9.00	11.00	2.60	224.0
770073	Manistique River										
	7/18/2000	0.01	C 0.09	0.00	0.39	0.02	0.01	18.00	2.00	7.10	135.0
	8/17/2000	T HT 0.01	C HT 0.04	HT 0.00	0.32	0.02	HT 0.02	18.00	2.00	5.60	190.0
	9/20/2000	HT 0.02	C HT 0.05	0.00	HT 0.41	HT 0.02	0.00	22.00	2.00	7.00	140.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.01	0.06	0.00	0.37	0.02	0.01	19.33	2.00	6.57	155.0
	Median+:	0.01	0.05	0.00	0.39	0.02	0.01	18.00	2.00	7.00	140.0
550038	Menominee River										
	7/20/2000	0.02	C 0.07	0.00	0.48	0.04	HT 0.01	11.00	5.00	12.00	151.0
	8/16/2000	T HT 0.01	C T 0.00	T HT 0.00	0.57	0.04	0.01	16.00	6.00	10.00	170.0
	9/26/2000	HT 0.02	C HT 0.06	0.00	HT 0.61	HT 0.03	0.01	12.00	6.00	13.00	180.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.02	0.04	0.00	0.55	0.04	0.01	13.00	5.67	11.67	167.0
	Median+:	0.02	0.06	0.00	0.57	0.04	0.01	12.00	6.00	12.00	170.0

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610273	Muskegon River (Lower)										
	7/12/2000	0.02	C 0.30	0.01	0.51	0.03	0.01	9.00	19.00	7.20	242.0
	8/2/2000	0.03	0.35	0.01	0.47	0.03	0.01	12.00	17.00	7.00	230.0
	8/30/2000	HT 0.02	C HT 0.27	0.01	0.39	0.03	0.01	15.00	19.00	6.00	250.0
	9/26/2000	HT 0.02	C HT 0.30	0.01	HT 0.36	HT 0.03	0.02	16.00	19.00	5.20	250.0
	10/24/2000	0.03	C 0.30	0.01	0.34	0.02	HT 0.01	16.00	20.00	4.20	260.0
	11/14/2000	0.05	C 0.30	0.01	0.34	0.02	0.01	16.00	19.00	4.60	260.0
	No. of Samples:	6	6	6	6	6	6	6	6	6	6
	Mean+:	0.03	0.30	0.01	0.40	0.03	0.01	14.00	18.83	5.70	248.7
	Median+:	0.03	0.30	0.01	0.38	0.03	0.01	15.50	19.00	5.60	250.0
670008	Muskegon River (Upper)										
	7/24/2000	T 0.01	C 0.10	0.00	0.22	0.01	0.00	11.00	15.00	4.10	251.0
	8/30/2000	HT 0.02	C HT 0.19	0.01	0.34	0.03	0.01	10.00	15.00	3.90	250.0
	9/25/2000	HT 0.01	C HT 0.24	0.00	HT 0.34	HT 0.02	0.01	10.00	14.00	4.80	240.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.01	0.18	0.00	0.30	0.02	0.01	10.33	14.67	4.27	247.0
	Median+:	0.01	0.19	0.00	0.34	0.02	0.01	10.00	15.00	4.10	250.0
660038	Ontonagon River										
	7/19/2000	T 0.01	C T 0.00	0.01	0.45	0.04	HT 0.01	5.00	2.00	8.80	80.0
	8/15/2000	T HT 0.01	C T 0.00	T HT 0.00	0.35	0.03	T HT 0.00	K 2.00	3.00	6.20	100.0
	9/11/2000	T HT 0.01	C T 0.00	T 0.00	HT 0.30	HT 0.03	0.01	5.00	3.00	4.70	120.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.01	0.00	0.00	0.37	0.03	0.01	* 3.67	2.67	6.57	100.0
	Median+:	0.01	0.00	0.00	0.35	0.03	0.01	5.00	3.00	6.20	100.0

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530027 Pere Marquette River										
7/12/2000	0.02	C 0.06	0.00	0.42	0.05	0.02	12.00	13.00	3.00	239.0
7/25/2000	0.01	C 0.05	0.00	0.32	0.03	0.01	17.00	14.00	2.50	246.0
8/2/2000	0.03	0.17	0.01	0.66	0.07	0.02	14.00	8.00	8.70	200.0
8/29/2000	HT 0.03	C HT 0.11	0.01	0.47	0.05	0.01	14.00	13.00	4.80	240.0
9/26/2000	HT 0.03	C HT 0.19	0.00	HT 0.48	HT 0.04	0.01	14.00	11.00	7.80	220.0
11/14/2000	0.04	C 0.24	0.01	0.51	0.03	0.01	14.00	11.00	8.10	220.0
No. of Samples:	6	6	6	6	6	6	6	6	6	6
Mean+:	0.03	0.14	0.01	0.48	0.05	0.01	14.17	11.67	5.82	227.5
Median+:	0.03	0.14	0.01	0.48	0.05	0.01	14.00	12.00	6.30	229.5
490006 Pine River (Mackinac Co.)										
7/13/2000	0.02	C 0.01	HT 0.00	0.39	0.06	HT 0.02	4.00	2.00	8.20	146.0
8/23/2000	HT 0.02	NAV	0.02	0.31	0.08	HT 0.02	5.00	2.00	5.80	150.0
9/18/2000	HT 0.02	C T 0.01	0.00	HT 0.30	HT 0.07	0.01	4.00	2.00	6.40	140.0
No. of Samples:	3	2	3	3	3	3	3	3	3	3
Mean+:	0.02	0.01	0.01	0.33	0.07	0.02	4.33	2.00	6.80	145.3
Median+:	0.02	0.01	0.00	0.31	0.07	0.02	4.00	2.00	6.40	146.0
580046 River Raisin										
8/8/2000	0.04	C HT 2.50	HT 0.03	0.96	0.17	HT 0.08	42.00	38.00	8.10	350.0
9/5/2000	HT 0.09	C HT 0.48	HT 0.01	0.79	0.07	HT 0.01	46.00	47.00	5.80	390.0
9/21/2000	HT 0.05	C HT 2.10	HT 0.01	HT 0.81	HT 0.12	HT 0.05	46.00	41.00	6.80	410.0
No. of Samples:	3	3	3	3	3	3	3	3	3	3
Mean+:	0.06	1.69	0.02	0.85	0.12	0.05	44.67	42.00	6.90	383.3
Median+:	0.05	2.10	0.01	0.81	0.12	0.05	46.00	41.00	6.80	390.0

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820070	River Rouge										
	7/27/2000	0.13	C HT 0.56	HT 0.01	0.48	0.07	HT 0.03	24.00	71.00	2.90	328.0
	7/31/2000	0.22	C 0.56	0.06	0.95	0.16	0.07	21.00	63.00	DM 9.50	280.0
	8/3/2000	0.31	C 0.61	0.04	1.18	0.20	0.08	22.00	76.00	6.30	330.0
	8/30/2000	HT 0.14	C HT 0.66	0.02	0.65	0.08	0.04	23.00	76.00	5.10	350.0
	9/13/2000	ST 0.11	C ST 0.71	0.04	HT 1.00	HT 0.16	0.07	23.00	57.00	ST 8.00	310.0
	11/29/2000	0.06	C 0.47	0.01	0.23	0.04	HT 0.01	16.00	33.00	2.20	220.0
	No. of Samples:	6	6	6	6	6	6	6	6	6	6
	Mean+:	0.16	0.60	0.03	0.75	0.12	0.05	21.50	62.67	5.67	303.0
	Median+:	0.14	0.59	0.03	0.80	0.12	0.06	22.50	67.00	5.70	319.0
730023	Shiawassee River										
	7/26/2000	0.02	C HT 0.21	HT 0.00	0.55	0.05	HT 0.02	38.00	72.00	5.60	447.0
	8/1/2000	0.10	C 2.20	0.04	1.19	0.17	0.05	32.00	48.00	K 0.50	370.0
	8/22/2000	HT 0.02	C HT 0.34	0.01	0.73	0.06	0.02	26.00	63.00	7.70	430.0
	9/12/2000	HT 0.07	C HT 0.64	0.01	HT 0.67	HT 0.08	0.03	28.00	66.00	6.60	420.0
	9/28/2000	HT 0.07	C HT 1.89	0.02	HT 1.21	HT 0.18	0.05	26.00	33.00	10.00	320.0
	11/28/2000	0.02	C 2.20	0.02	0.67	0.03	HT 0.01	41.00	77.00	7.90	510.0
	No. of Samples:	6	6	6	6	6	6	6	6	6	6
	Mean+:	0.05	1.25	0.02	0.84	0.10	0.03	31.83	59.83	* 6.34	416.2
	Median+:	0.05	1.27	0.02	0.70	0.07	0.03	30.00	64.50	7.15	425.0
110628	St. Joseph River (Lower)										
	7/18/2000	T 0.01	C 1.45	0.01	0.64	0.07	0.02	42.00	29.00	7.50	376.0
	8/24/2000	T HT 0.01	C HT 1.33	0.01	0.53	0.07	PI 0.02	40.00	34.00	4.30	390.0
	9/27/2000	HT 0.06	C HT 1.46	0.01	HT 0.53	HT 0.08	0.04	42.00	31.00	4.80	370.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.03	1.41	0.01	0.57	0.07	0.03	41.33	31.33	5.53	378.7
	Median+:	0.01	1.45	0.01	0.53	0.07	0.02	42.00	31.00	4.80	376.0

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750273	St. Joseph River (Upper)										
	7/17/2000	0.09	C 1.32	0.02	0.63	0.04	0.01	40.00	22.00	6.10	345.0
	8/1/2000	0.11	1.47	0.03	0.62	0.05	0.02	34.00	20.00	21.00	340.0
	8/23/2000	HT 0.07	C HT 1.39	0.02	0.46	0.03	0.01	34.00	21.00	5.60	340.0
	9/27/2000	HT 0.06	C HT 1.40	0.01	HT 0.47	HT 0.03	0.01	38.00	22.00	5.20	340.0
	10/19/2000	HT 0.06	C HT 1.63	0.01	0.56	0.02	0.01	35.00	22.00	5.00	350.0
	11/15/2000	0.08	C 1.47	0.01	0.48	0.01	0.17	35.00	23.00	5.10	350.0
	No. of Samples:	6	6	6	6	6	6	6	6	6	6
	Mean+:	0.08	1.45	0.02	0.54	0.03	0.04	36.00	21.67	8.00	344.2
	Median+:	0.08	1.44	0.02	0.52	0.03	0.01	35.00	22.00	5.40	342.5
210032	Sturgeon River (Delta Co.)										
	7/26/2000	0.02	C 0.05	HT 0.00	0.45	0.02	HT 0.00	31.00	2.00	10.00	177.0
	8/29/2000	HT 0.02	C HT 0.04	T 0.00	0.38	0.02	HT 0.00	28.00	3.00	7.80	180.0
	9/25/2000	HT 0.02	C HT 0.05	0.00	HT 0.63	HT 0.02	0.00	28.00	3.00	19.00	140.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.02	0.05	0.00	0.49	0.02	0.00	29.00	2.67	12.27	165.7
	Median+:	0.02	0.05	0.00	0.45	0.02	0.00	28.00	3.00	10.00	177.0
170141	Tahquamenon River										
	7/18/2000	0.03	C 0.09	0.01	0.53	0.02	0.01	8.00	2.00	14.00	109.0
	8/14/2000	HT 0.01	C HT 0.07	HT 0.00	0.34	0.02	HT 0.00	6.00	2.00	6.90	120.0
	9/12/2000	HT 0.01	C HT 0.07	T 0.00	HT 0.30	HT 0.01	0.01	7.00	2.00	4.80	120.0
	No. of Samples:	3	3	3	3	3	3	3	3	3	3
	Mean+:	0.02	0.08	0.00	0.39	0.02	0.01	7.00	2.00	8.57	116.3
	Median+:	0.01	0.07	0.00	0.34	0.02	0.01	7.00	2.00	6.90	120.0

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STORET ID	Ammonia (mg N/L)	Nitrate (mg N/L)	Nitrite (mg N/L)	Kjeldahl Nitrogen (mg N/L)	Phosphorus (mg P/L)	Ortho Phosphate (mg P/L)	Sulfate (mg/L)	Chloride (mg/L)	Organic Carbon (mg/L)	Dissolved Solids (mg/L)
040123 Thunder Bay River										
7/12/2000	0.03	C 0.02	0.00	0.47	0.02	0.01	4.00	6.00	6.40	217.0
8/2/2000	0.03	0.01	0.00	0.36	0.02	0.01	6.00	5.00	5.70	210.0
8/10/2000	0.03	C 0.02	0.00	0.37	0.02	0.01	5.00	6.00	6.50	210.0
8/21/2000	HT 0.02	C T 0.01	T 0.00	0.46	0.02	0.00	8.00	6.00	7.20	210.0
9/19/2000	HT 0.04	C HT 0.01	0.00	HT 0.39	HT 0.02	0.01	7.00	6.00	5.20	220.0
11/27/2000	0.01	C 0.05	0.00	0.36	0.01	HT 0.00	10.00	9.00	7.50	250.0
No. of Samples:	6	6	6	6	6	6	6	6	6	6
Mean+:	0.03	0.02	0.00	0.40	0.02	0.01	6.67	6.33	6.42	219.5
Median+:	0.03	0.02	0.00	0.38	0.02	0.01	6.50	6.00	6.45	213.5
730025 Tittabawassee River										
7/19/2000	0.04	C 0.38	0.02	0.87	0.07	HT 0.02	46.00	152.00	9.10	590.0
8/14/2000	HT 0.07	C HT 0.60	HT 0.03	0.76	0.07	HT 0.04	29.00	204.00	7.80	690.0
9/12/2000	HT 0.09	C HT 0.30	0.01	HT 0.77	HT 0.08	0.04	30.00	120.00	6.60	490.0
No. of Samples:	3	3	3	3	3	3	3	3	3	3
Mean+:	0.07	0.43	0.02	0.80	0.07	0.03	35.00	158.67	7.83	590.0
Median+:	0.07	0.38	0.02	0.77	0.07	0.04	30.00	152.00	7.80	590.0

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STORET ID		Suspended Solids (mg/L)	Hardness (Ca2CO3) (mg/L)	Conductivity (Lab) (umho/cm)	Conductivity (Field) (umho/cm)	Dissolved Oxygen (mg/L)	pH (Lab) (S.U.)	pH (Field) (S.U.)	Temperature (°C)	Turbidity (NTU)
350061	Au Sable River									
7/12/2000		K 4.00	145.00	295.00	297.00	7.40	8.18	8.00	22.40	K 0.40
8/2/2000		K 4.00	138.00	293.00	292.00	7.20	8.13	7.90	13.40	K 0.40
8/22/2000		K 4.00	145.00	295.00	294.00	7.60	8.10	7.90	21.50	K 0.40
9/19/2000		K 4.00	183.00	304.00	297.00	8.00	8.16	7.90	19.30	K 0.40
10/18/2000		K 4.00	157.00	309.00	305.00	9.30	8.13	7.60	13.50	0.40
11/28/2000		K 4.00	169.00	324.00	319.00	11.60	8.22	7.80	4.00	K 0.40
No. of Samples:		6	6	6	6	6	6	6	6	6
Mean+:		* 2.00	156.17	303.33	300.67	8.52	8.15	7.85	15.6	* 0.23
Median+:		K 4.00	151.00	299.50	297.00	7.80	8.15	7.90	16.4	0.40
740385	Black River (St. Clair Co.)									
7/26/2000		21.00	146.00	351.00	307.00	6.76	8.12	7.73	23.00	16.00
8/16/2000		31.00	210.00	478.00			8.09			29.00
9/18/2000		13.00	235.00	525.00			8.22			HT 12.00
No. of Samples:		3	3	3	1	1	3	1	1	3
Mean+:		21.67	197.00	451.33	307.00	6.76	8.14	7.73	23.0	19.0
Median+:		21.00	210.00	478.00	307.00	6.76	8.12	7.73	23.0	16.0
730024	Cass River									
7/19/2000		28.00	335.00	741.00	717.00	9.00	HT 8.42	8.20	23.30	24.00
8/15/2000		40.00	335.00	694.00	686.00	7.35	8.42	8.15	23.00	31.00
9/12/2000		56.00	230.00	681.00	647.00	6.12	8.14	7.86	21.50	50.00
No. of Samples:		3	3	3	3	3	3	3	3	3
Mean+:		41.33	300.00	705.33	683.33	7.49	8.33	8.07	22.6	35.0
Median+:		40.00	335.00	694.00	686.00	7.35	8.42	8.15	23.0	31.0

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STORET ID		Suspended Solids (mg/L)	Hardness (Ca2CO3) (mg/L)	Conductivity (Lab) (umho/cm)	Conductivity (Field) (umho/cm)	Dissolved Oxygen (mg/L)	pH (Lab) (S.U.)	pH (Field) (S.U.)	Temperature (°C)	Turbidity (NTU)
160073	Cheboygan River									
7/11/2000		K 4.00	155.00	313.00	292.00	8.60	8.59	8.35	23.60	K 0.40
8/1/2000		K 4.00	147.00	311.00	313.00	8.30	8.38	8.20	23.80	0.50
8/10/2000		K 4.00	154.00	315.00	316.00	7.44	8.25	7.99	21.80	QC 0.50
8/21/2000		K 4.00	151.00	311.00	308.00	8.40	8.24	7.90	20.50	0.50
9/18/2000		K 4.00	205.00	317.00	314.00	9.30	8.35	8.30	17.50	K 0.40
11/27/2000		K 4.00	163.00	326.00	319.00	13.00	8.38	7.90	2.30	K 0.40
No. of Samples:		6	6	6	6	6	6	6	6	6
Mean+:		* 2.00	162.50	315.50	310.33	9.17	8.37	8.11	18.2	* 0.35
Median+:		K 4.00	154.50	314.00	313.50	8.50	8.37	8.10	21.1	# 0.45
500233	Clinton River									
7/20/2000		17.00	260.00	962.00	935.00	8.00	8.22	7.90	19.50	11.00
7/31/2000		67.00	230.00	399.00	397.00	5.60	7.68	7.40	21.00	HT 56.00
8/3/2000		65.00	167.00	494.00	492.00	5.35	7.64	7.26	21.30	85.00
8/30/2000		K 4.00	275.00	907.00	893.00	7.60	8.18	7.60	22.80	5.20
9/13/2000		54.00	395.00	547.00	482.00	5.80	7.71	7.41	19.70	55.00
11/28/2000		5.00	295.00	874.00	844.00	11.00	8.11	7.70	6.20	9.20
No. of Samples:		6	6	6	6	6	6	6	6	6
Mean+:		* 35.00	270.33	697.17	673.83	7.23	7.92	7.55	18.4	36.9
Median+:		35.50	267.50	710.50	668.00	6.70	7.91	7.51	20.3	33.0

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STORET ID		Suspended Solids (mg/L)	Hardness (Ca2CO3) (mg/L)	Conductivity (Lab) (umho/cm)	Conductivity (Field) (umho/cm)	Dissolved Oxygen (mg/L)	pH (Lab) (S.U.)	pH (Field) (S.U.)	Temperature (°C)	Turbidity (NTU)
210102	Escanaba River									
7/25/2000		K 4.00	123.00	571.00	571.00	9.40	HT 7.99	7.90	20.50	6.40
8/7/2000		K 4.00	128.00	544.00	545.00	6.30	7.96	7.80	21.90	4.60
8/28/2000		4.00	140.00	711.00	714.00	6.40	7.97	7.80	22.00	5.00
9/25/2000		K 4.00	122.00	478.00	480.00	8.80	7.96	7.40	12.20	4.40
10/16/2000		7.00	100.00	358.00	354.00		7.92	7.24		6.40
11/29/2000		7.00	109.00	435.00	425.00	13.60	7.98	7.60	1.20	7.60
No. of Samples:		6	6	6	6	5	6	6	5	6
Mean+:		* 4.00	120.33	516.17	514.83	8.90	7.96	7.62	15.5	5.73
Median+:		# 4.00	122.50	511.00	512.50	8.80	7.97	7.70	20.5	5.70
730285	Flint River									
8/22/2000		18.00	250.00	724.00	717.00	8.72	8.55	8.14	20.80	10.00
9/6/2000		K 4.00	240.00	794.00	771.00	7.90	8.47	8.30	18.10	17.00
9/28/2000		58.00	235.00	568.00	563.00	9.40	8.08	7.70	13.80	38.00
No. of Samples:		3	3	3	3	3	3	3	3	3
Mean+:		* 26.00	241.67	695.33	683.67	8.67	8.37	8.05	17.5	21.6
Median+:		18.00	240.00	724.00	717.00	8.72	8.47	8.14	18.1	17.0
700123	Grand River (Lower)									
7/11/2000		35.00	265.00	623.00	599.00	8.19	8.20	7.82	23.90	21.00
8/1/2000		28.00	250.00	585.00	585.00	9.90	8.32	8.20	22.80	15.00
8/31/2000		21.00	250.00	653.00	649.00	9.63	8.58	8.31	23.50	14.00
9/26/2000		70.00	195.00	477.00	440.00	8.90	7.90	7.80	14.00	68.00
10/23/2000		10.00	315.00	730.00	725.00	9.20	8.13	7.70	14.10	4.90
11/14/2000		13.00	290.00	640.00	618.00	10.60	8.16	7.94	7.00	8.60
No. of Samples:		6	6	6	6	6	6	6	6	6
Mean+:		29.50	260.83	618.00	602.67	9.40	8.22	7.96	17.5	21.9
Median+:		24.50	257.50	631.50	608.50	9.42	8.18	7.88	18.4	14.5

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STORET ID	Suspended Solids (mg/L)	Hardness (Ca2CO3) (mg/L)	Conductivity (Lab) (umho/cm)	Conductivity (Field) (umho/cm)	Dissolved Oxygen (mg/L)	pH (Lab) (S.U.)	pH (Field) (S.U.)	Temperature (°C)	Turbidity (NTU)
340025 Grand River (Upper)									
7/24/2000	17.00	290.00	682.00	673.00	8.87	HT 8.50	8.24	21.70	QC 10.00
9/7/2000	10.00	290.00	709.00	674.00	8.36	8.40	8.00	20.60	7.00
9/26/2000	28.00	225.00	486.00	449.00	8.90	7.86	7.00	13.10	44.00
No. of Samples:	3	3	3	3	3	3	3	3	3
Mean+:	18.33	268.33	625.67	598.67	8.71	8.25	7.75	18.4	20.3
Median+:	17.00	290.00	682.00	673.00	8.87	8.40	8.00	20.6	10.0
580364 Huron River									
7/20/2000	17.00	235.00	651.00	257.00	5.90	8.03	7.80	23.60	13.00
8/9/2000	35.00	265.00	704.00	694.00	6.80	7.98	7.70	24.20	QC 21.00
9/5/2000	NH 175.00	225.00	642.00	632.00	7.60	8.03	7.70	21.00	HT 14.00
No. of Samples:	3	3	3	3	3	3	3	3	3
Mean+:	75.67	241.67	665.67	527.67	6.77	8.01	7.73	22.9	16.0
Median+:	35.00	235.00	651.00	632.00	6.80	8.03	7.70	23.6	14.0
030077 Kalamazoo River (Lower)									
7/11/2000	31.00	270.00	584.00	566.00	6.62	8.18	7.72	21.80	16.00
8/1/2000	32.00	245.00	619.00	621.00	8.90	8.24	8.10	22.90	13.00
8/10/2000	35.00	155.00	587.00	580.00	7.49	8.26	7.97	22.60	QC 16.00
9/7/2000	28.00	315.00	608.00	579.00	9.12	8.50	7.95	20.10	11.00
9/26/2000	24.00	188.00	453.00	415.00	8.50	7.80	7.70	12.70	33.00
11/15/2000	12.00	280.00	652.00	638.00	11.30	8.18	7.90	6.10	5.90
No. of Samples:	6	6	6	6	6	6	6	6	6
Mean+:	27.00	242.17	583.83	566.50	8.66	8.19	7.89	17.7	15.8
Median+:	29.50	257.50	597.50	579.50	8.70	8.21	7.93	20.9	14.5

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STORET ID		Suspended Solids (mg/L)	Hardness (Ca2CO3) (mg/L)	Conductivity (Lab) (umho/cm)	Conductivity (Field) (umho/cm)	Dissolved Oxygen (mg/L)		pH (Lab) (S.U.)	pH (Field) (S.U.)	Temperature (°C)	Turbidity (NTU)
390057	Kalamazoo River (Upper)										
	7/18/2000	14.00	295.00	667.00				8.26			5.90
	8/23/2000	23.00	153.00	662.00	620.00	7.10		8.18	7.60	21.10	7.90
	9/21/2000	K 4.00	300.00	643.00	638.00	7.12		8.12	7.68	16.00	2.50
	No. of Samples:	3	3	3	2	2		3	2	2	3
	Mean+:	* 13.00	249.33	657.33	629.00	7.11		8.19	7.64	18.5	5.43
	Median+:	14.00	295.00	662.00	629.00	7.11		8.18	7.64	18.5	5.90
510088	Manistee River										
	7/25/2000	12.00	160.00	345.00	337.00	8.42	HT	8.28	8.19	20.32	4.40
	8/29/2000	6.00	154.00	342.00	328.00	8.52		8.26	8.02	21.00	3.50
	9/25/2000	4.00	162.00	350.00	338.00	9.71		8.18	7.65	14.40	2.20
	No. of Samples:	3	3	3	3	3		3	3	3	3
	Mean+:	7.33	158.67	345.67	334.33	8.88		8.24	7.95	18.5	3.37
	Median+:	6.00	160.00	345.00	337.00	8.52		8.26	8.02	20.3	3.50
770073	Manistique River										
	7/18/2000	K 4.00	102.00	208.00	210.00	7.50		7.92	7.80	20.40	4.80
	8/17/2000	K 4.00	108.00	211.00	209.00	7.70		7.95	7.50	19.90	3.40
	9/20/2000	K 4.00	106.00	212.00	204.00	8.40		7.88	7.60	16.30	3.50
	No. of Samples:	3	3	3	3	3		3	3	3	3
	Mean+:	* 2.00	105.33	210.33	207.67	7.87		7.92	7.63	18.8	3.90
	Median+:	K 4.00	106.00	211.00	209.00	7.70		7.92	7.60	19.9	3.50

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STORET ID		Suspended Solids (mg/L)	Hardness (Ca2CO3) (mg/L)	Conductivity (Lab) (umho/cm)	Conductivity (Field) (umho/cm)	Dissolved Oxygen (mg/L)		pH (Lab) (S.U.)	pH (Field) (S.U.)	Temperature (°C)		Turbidity (NTU)
550038	Menominee River											
7/20/2000		6.00	107.00	232.00	228.00	7.62		8.11	7.80	21.80		3.80
8/16/2000		5.00	113.00	254.00	257.00	7.60		8.25	7.90	23.70		4.60
9/26/2000	K	4.00	131.00	278.00	278.00	9.70		8.03	7.50	13.60		3.00
No. of Samples:		3	3	3	3	3		3	3	3		3
Mean+:	*	4.33	117.00	254.67	254.33	8.31		8.13	7.73	19.7		3.80
Median+:		5.00	113.00	254.00	257.00	7.62		8.11	7.80	21.8		3.80
610273	Muskegon River (Lower)											
7/12/2000		10.00	172.00	372.00	365.00	7.56		8.24	7.98	21.70		3.60
8/2/2000		13.00	162.00	360.00	351.00	8.20		8.11	7.80	21.60		4.40
8/30/2000	K	4.00	160.00	377.00	346.00	8.18		8.23	7.97	22.50		2.10
9/26/2000	K	4.00	183.00	392.00	364.00	9.39		8.18	7.69	15.75		2.60
10/24/2000	K	4.00	187.00	406.00	387.00	7.80		8.12	9.00	14.00		0.60
11/14/2000		7.00	178.00	402.00	383.00	10.80		8.18	7.90	8.40		2.50
No. of Samples:		6	6	6	6	6		6	6	6		6
Mean+:	*	6.00	173.67	384.83	366.00	8.66		8.18	8.06	17.3		2.63
Median+:	#	5.50	175.00	384.50	364.50	8.19		8.18	7.94	18.6		2.55
670008	Muskegon River (Upper)											
7/24/2000		6.00	169.00	386.00	373.00	10.46	HT	8.48	8.29	19.61	QC	1.50
8/30/2000		6.00	171.00	386.00	360.00	8.50		8.19	7.99	18.10		3.60
9/25/2000		9.00	168.00	368.00	382.00	10.90		8.19	7.71	10.40		4.30
No. of Samples:		3	3	3	3	3		3	3	3		3
Mean+:		7.00	169.33	380.00	371.67	9.95		8.29	8.00	16.0		3.13
Median+:		6.00	169.00	386.00	373.00	10.4		8.19	7.99	18.1		3.60

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660038	Ontonagon River										
	7/19/2000	9.00	58.00	123.00	117.00	8.10	HT	8.03	7.80	20.40	16.00
	8/15/2000	13.00	79.00	161.00	160.00	7.20		8.01	7.50	23.20	14.00
	9/11/2000	12.00	88.00	181.00	174.00	8.50		8.06	7.40	20.10	12.00
	No. of Samples:	3	3	3	3	3		3	3	3	3
	Mean+:	11.33	75.00	155.00	150.33	7.93		8.03	7.57	21.2	14.0
	Median+:	12.00	79.00	161.00	160.00	8.10		8.03	7.50	20.4	14.0
530027	Pere Marquette River										
	7/12/2000	23.00	180.00	368.00	356.00	7.90		8.23	7.85	19.40	8.90
	7/25/2000	16.00	164.00	379.00	352.00	8.86	HT	8.19	7.90	16.44	6.20
	8/2/2000	25.00	149.00	308.00	301.00	7.20		7.88	7.50	19.00	12.00
	8/29/2000	10.00	163.00	368.00	339.00	8.13		8.06	7.80	18.60	8.10
	9/26/2000	8.00	169.00	343.00	326.00	9.81		8.00	7.54	9.47	6.30
	11/14/2000	7.00	157.00	334.00	315.00	11.10		8.01	7.61	5.50	3.90
	No. of Samples:	6	6	6	6	6		6	6	6	6
	Mean+:	14.83	163.67	350.00	331.50	8.83		8.06	7.70	14.7	7.57
	Median+:	13.00	163.50	355.50	332.50	8.50		8.04	7.71	17.5	7.20
490006	Pine River (Mackinac Co.)										
	7/13/2000	18.00	118.00	224.00	202.00	8.20		8.36	7.80	21.50	33.00
	8/23/2000	27.00	64.00	226.00	222.00	8.90		8.21	7.80	19.00	43.00
	9/18/2000	22.00	118.00	211.00	204.00	10.10		8.24	8.03	14.70	HT 31.00
	No. of Samples:	3	3	3	3	3		3	3	3	3
	Mean+:	22.33	100.00	220.33	209.33	9.07		8.27	7.88	18.4	35.6
	Median+:	22.00	118.00	224.00	204.00	8.90		8.24	7.80	19.0	33.0

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580046	River Raisin									
	8/8/2000	28.00	225.00	546.00	571.00	7.60	8.13	7.80	23.40	28.00
	9/5/2000	6.00	230.00	593.00	588.00	7.10	8.22	7.70	23.70	HT 16.00
	9/21/2000	29.00	290.00	626.00	618.00	7.60	8.23	7.97	18.60	31.00
	No. of Samples:	3	3	3	3	3	3	3	3	3
	Mean+:	21.00	248.33	588.33	592.33	7.43	8.19	7.82	21.9	25.0
	Median+:	28.00	230.00	593.00	588.00	7.60	8.22	7.80	23.4	28.0
820070	River Rouge									
	7/27/2000	22.00	146.00	504.00	488.00	6.15	8.03	7.50	24.50	16.00
	7/31/2000	40.00	115.00	430.00	420.00	4.70	7.65	7.40	22.10	HT 42.00
	8/3/2000	53.00	137.00	509.00	506.00	3.79	7.50	7.18	23.30	52.00
	8/30/2000	6.00	150.00	532.00	526.00	5.50	7.78	7.80	25.80	7.50
	9/13/2000	23.00	149.00	472.00	470.00	5.22	7.56	7.13	20.80	42.00
	11/29/2000	7.00	124.00	343.00	340.00	11.90	8.08	7.70	4.10	12.00
	No. of Samples:	6	6	6	6	6	6	6	6	6
	Mean+:	25.17	136.83	465.00	458.33	6.21	7.77	7.45	20.1	28.5
	Median+:	22.50	141.50	488.00	479.00	5.36	7.72	7.45	22.7	29.0
730023	Shiawassee River									
	7/26/2000	24.00	260.00	687.00	650.00	6.72	8.30	8.03	22.30	12.00
	8/1/2000	72.00	134.00	564.00	555.00	7.24	8.09	7.96	22.80	36.00
	8/22/2000	20.00	260.00	665.00	657.00	7.79	8.43	7.96	19.60	12.00
	9/12/2000	21.00	310.00	651.00	659.00	7.48	8.11	7.95	20.90	15.00
	9/28/2000	60.00	225.00	496.00	491.00	10.10	8.03	7.60	12.80	38.00
	11/28/2000	K 4.00	330.00	785.00	758.00	12.50	8.39	8.00	3.40	3.20
	No. of Samples:	6	6	6	6	6	6	6	6	6
	Mean+:	* 33.17	253.17	641.33	628.33	8.64	8.23	7.92	16.9	19.3
	Median+:	22.50	260.00	658.00	653.50	7.64	8.21	7.96	20.2	13.5

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STORET ID		Suspended Solids (mg/L)	Hardness (Ca2CO3) (mg/L)	Conductivity (Lab) (umho/cm)	Conductivity (Field) (umho/cm)	Dissolved Oxygen (mg/L)	pH (Lab) (S.U.)	pH (Field) (S.U.)	Temperature (°C)	Turbidity (NTU)
110628	St. Joseph River (Lower)									
7/18/2000		11.00	265.00	578.00			8.31			8.20
8/24/2000		10.00	150.00	598.00	598.00	8.40	8.31	7.90	23.10	6.60
9/27/2000		12.00	275.00	569.00	524.00	8.30	8.06	7.70	15.60	7.40
No. of Samples:		3	3	3	2	2	3	2	2	3
Mean+:		11.00	230.00	581.67	561.00	8.35	8.23	7.80	19.3	7.40
Median+:		11.00	265.00	578.00	561.00	8.35	8.31	7.80	19.3	7.40
750273	St. Joseph River (Upper)									
7/17/2000		5.00	255.00	531.00			7.98			4.00
8/1/2000		10.00	250.00	524.00	500.00	6.00	7.90	7.70	23.50	6.40
8/23/2000		6.00	135.00	525.00	498.00	7.20	7.98	7.50	22.90	1.70
9/27/2000		6.00		520.00	480.00	8.40	8.02	8.00	15.30	3.90
10/19/2000		9.00	265.00	536.00	530.00	8.80	8.00	7.80	14.60	3.40
11/15/2000	K	4.00	260.00	545.00	530.00	11.40	8.16	7.92	5.80	0.70
No. of Samples:		6	5	6	5	5	6	5	5	6
Mean+:	*	6.33	233.00	530.17	507.60	8.36	8.01	7.78	16.4	3.35
Median+:		6.00	255.00	528.00	500.00	8.40	7.99	7.80	15.3	3.65
210032	Sturgeon River (Delta Co.)									
7/26/2000	K	4.00	137.00	272.00	270.00	7.59	7.88	7.59	20.10	4.10
8/29/2000	A	4.00	132.00	277.00	276.00	7.50	7.97	7.50	19.50	3.10
9/25/2000		5.00	105.00	210.00	203.00	10.20	7.78	7.10	8.90	4.60
No. of Samples:		3	3	3	3	3	3	3	3	3
Mean+:	*	3.67	124.67	253.00	249.67	8.43	7.88	7.40	16.1	3.93
Median+:		4.00	132.00	272.00	270.00	7.59	7.88	7.50	19.5	4.10

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170141	Tahquamenon River									
7/18/2000		K 4.00	81.00	167.00	166.00	7.60	7.84	7.80	20.60	4.10
8/14/2000		K 4.00	93.00	182.00	182.00	8.20	8.16	7.70	21.20	2.60
9/12/2000		K 4.00	92.00	190.00	187.00	9.10	8.07	7.70	18.80	2.30
No. of Samples:		3	3	3	3	3	3	3	3	3
Mean+:		* 2.00	88.67	179.67	178.33	8.30	8.02	7.73	20.2	3.00
Median+:		K 4.00	92.00	182.00	182.00	8.20	8.07	7.70	20.6	2.60
040123	Thunder Bay River									
7/12/2000		K 4.00	164.00	334.00	338.00	7.10	8.25	8.10	23.30	1.70
8/2/2000		5.00	156.00	320.00			8.10			1.60
8/10/2000		K 4.00	235.00	316.00	323.00	6.94	8.11	7.85	21.80	QC 0.70
8/21/2000		K 4.00	167.00	328.00	325.00	8.30	8.23	8.00	20.50	1.60
9/19/2000		K 4.00	210.00	344.00	336.00	8.30	8.15	7.80	18.80	1.70
11/27/2000		K 4.00	184.00	383.00	375.00	13.00	8.21	7.90	1.20	2.90
No. of Samples:		6	6	6	5	5	6	5	5	6
Mean+:		* 2.50	186.00	337.50	339.40	8.73	8.18	7.93	17.1	1.70
Median+:		K 4.00	175.50	331.00	336.00	8.30	8.18	7.90	20.5	1.65
730025	Tittabawassee River									
7/19/2000		14.00	235.00	908.00	880.00	8.50	HT 8.29	8.00	23.20	8.00
8/14/2000		11.00	260.00	1063.0	1052.0	7.61	8.27	8.02	23.80	5.90
9/12/2000		16.00	250.00	761.00	727.00	6.59	8.03	7.67	21.90	12.00
No. of Samples:		3	3	3	3	3	3	3	3	3
Mean+:		13.67	248.33	910.67	886.33	7.57	8.20	7.90	22.9	8.63
Median+:		14.00	250.00	908.00	880.00	7.61	8.27	8.00	23.2	8.00

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STORET ID		Mercury (ng/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Nickel (ug/L)	Lead (ug/L)	Zinc (ug/L)
350061	Au Sable River							
7/12/2000		0.350	0.002	0.070	0.270	0.780	0.029	0.000
8/2/2000		0.220	0.002	0.080	0.240	1.220	0.023	0.090
8/22/2000		0.200	0.000	0.090	0.280	0.580	0.023	0.110
9/19/2000	MSD	0.120	0.020	ELOD 0.010	0.220	0.860	0.035	0.150
10/18/2000		0.130	0.008	0.060	0.180	0.670	0.055	1.800
11/28/2000		0.080	0.003	0.110	0.160	0.750	0.029	0.150
No. of Samples:		6	6	6	6	6	6	6
Mean+:		0.183	0.006	0.070	0.225	0.810	0.032	0.383
Median+:		0.165	0.003	0.075	0.230	0.765	0.029	0.130
740385	Black River (St. Clair Co.)							
7/26/2000		1.450	0.020	0.720	2.130	1.840	0.694	3.680
8/16/2000		3.130	0.030	1.230	3.240	2.700	1.000	5.440
9/18/2000	MSD	1.370	0.020	0.980	2.030	2.180	0.527	6.120
No. of Samples:		3	3	3	3	3	3	3
Mean+:		1.983	0.023	0.977	2.467	2.240	0.740	5.080
Median+:		1.450	0.020	0.980	2.130	2.180	0.694	5.440
730024	Cass River							
7/19/2000		2.290	0.020	0.910	1.910	3.660	0.594	3.240
8/15/2000		2.830	0.020	1.260	2.260	3.300	0.862	4.670
9/12/2000		1.770	0.020	1.540	2.320	3.710	1.110	9.700
No. of Samples:		3	3	3	3	3	3	3
Mean+:		2.297	0.020	1.237	2.163	3.557	0.855	5.870
Median+:		2.290	0.020	1.260	2.260	3.660	0.862	4.670

+ = Calculated value; not rounded to the appropriate number of significant figures.
BSQC = Batch spike exceeded quality control criteria.
CCB = Continuing calibration blank exceeded detection level.
ELOD = Matrix problem; elevated detection level reported.
ISQC = Internal standard exceeded quality control criteria.
MS = Matrix spike exceeded quality control criteria.
MSD = Matrix spike duplicate exceeded quality control criteria.
SLRS = SLRS control exceeded quality control criteria.

STORET ID		Mercury (ng/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Nickel (ug/L)	Lead (ug/L)	Zinc (ug/L)
160073	Cheboygan River							
7/11/2000		0.250	0.001	CCB 0.110	0.520	1.090	0.029	0.140
8/1/2000		0.330	0.003	0.090	0.530	0.960	0.033	0.180
8/10/2000		0.350	0.001	0.130	0.700	0.950	0.063	0.270
8/21/2000		1.430	0.000	0.110	0.520	0.600	0.056	0.220
9/18/2000	MSD	0.140	0.020	0.190	0.550	0.790	0.408	0.170
11/27/2000		0.150	0.006	0.100	0.760	0.800	0.025	0.230
No. of Samples:		6	6	6	6	6	6	6
Mean+:		0.442	0.005	0.122	0.597	0.865	0.102	0.202
Median+:		0.290	0.002	0.110	0.540	0.875	0.045	0.200
500233	Clinton River							
7/20/2000		2.990	0.040	0.990	3.330	4.850	0.816	8.570
7/31/2000		8.130	0.100	3.580	6.670	4.070	4.170	19.900
8/3/2000		12.260	0.100	3.360	6.230	4.710	4.070	19.100
8/30/2000		1.470	0.030	0.720	3.460	4.090	0.655	11.100
9/13/2000		5.960	0.080	3.190	5.860	3.930	3.400	14.500
11/28/2000		2.010	0.050	0.760	2.290	2.680	0.653	7.290
No. of Samples:		6	6	6	6	6	6	6
Mean+:		5.470	0.067	2.100	4.640	4.055	2.294	13.410
Median+:		4.475	0.065	2.090	4.660	4.080	2.108	12.800
210102	Escanaba River							
7/25/2000		3.160	0.120	0.780	1.520	0.770	0.148	7.640
8/7/2000		3.300	0.090	0.720	1.520	0.620	0.114	SLRS 6.980
8/28/2000	MS	2.920	0.110	0.960	2.330	0.780	0.162	10.500
9/25/2000		2.450	0.060	0.850	1.250	0.810	0.231	6.110
10/16/2000		2.550	0.020	0.720	0.980	0.330	0.191	3.400
11/29/2000		2.070	0.050	0.690	0.960	0.450	0.171	5.890
No. of Samples:		6	6	6	6	6	6	6
Mean+:		2.742	0.075	0.787	1.427	0.627	0.170	6.753
Median+:		2.735	0.075	0.750	1.385	0.695	0.167	6.545

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STORET ID	Mercury (ng/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Nickel (ug/L)	Lead (ug/L)	Zinc (ug/L)
730285 Flint River							
8/22/2000	3.930	0.020	1.000	2.530	4.110	1.470	10.700
9/6/2000	0.760	0.030	0.700	2.630	4.570	0.698	9.110
9/28/2000	5.360	0.070	2.650	3.990	3.350	4.310	17.900
No. of Samples:	3	3	3	3	3	3	3
Mean+:	3.350	0.040	1.450	3.050	4.010	2.159	12.570
Median+:	3.930	0.030	1.000	2.630	4.110	1.470	10.700
700123 Grand River (Lower)							
7/11/2000	5.400	0.050	1.880	3.640	3.000	3.660	10.700
8/1/2000	2.880	0.030	1.070	2.410	3.220	1.220	4.640
8/31/2000	1.780	0.020	0.750	2.170	3.120	0.656	4.800
9/26/2000	7.660	0.060	BSQC 2.700	3.820	3.250	3.000	BSQC 12.000
10/23/2000	1.430	0.020	0.510	1.670	3.020	0.523	3.370
11/14/2000	2.270	0.030	0.780	2.160	2.580	0.842	6.540
No. of Samples:	6	6	6	6	6	6	6
Mean+:	3.570	0.035	1.282	2.645	3.032	1.650	7.008
Median+:	2.575	0.030	0.925	2.290	3.070	1.031	5.670
340025 Grand River (Upper)							
7/24/2000	2.880	0.030	0.640	2.670	4.120	0.847	3.000
9/7/2000	1.300	0.020	0.540	2.530	3.750	0.593	8.330
9/26/2000	7.140	0.040	BSQC 1.800	3.540	2.690	2.070	BSQC 11.000
No. of Samples:	3	3	3	3	3	3	3
Mean+:	3.773	0.030	0.993	2.913	3.520	1.170	7.443
Median+:	2.880	0.030	0.640	2.670	3.750	0.847	8.330
580364 Huron River							
7/20/2000	2.480	0.030	0.550	1.930	3.520	2.030	9.380
8/9/2000	2.880	0.050	1.010	3.310	3.020	2.590	SLRS 33.930
9/5/2000	1.020	0.040	0.570	2.270	2.840	2.050	54.600
No. of Samples:	3	3	3	3	3	3	3
Mean+:	2.127	0.040	0.710	2.503	3.127	2.223	32.637
Median+:	2.480	0.040	0.570	2.270	3.020	2.050	33.930

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030077	Kalamazoo River (Lower)							
7/11/2000		8.280	0.030	0.880	1.820	2.250	1.940	4.370
8/1/2000		8.800	0.030	0.830	1.860	3.040	1.800	11.700
8/10/2000		7.210	0.030	0.880	1.780	2.380	1.700	4.490
9/7/2000		3.230	0.030	0.540	1.310	2.500	1.110	3.850
9/26/2000		5.220	0.030	BSQC 1.100	2.350	1.990	1.390	BSQC 6.200
11/15/2000		3.800	0.030	0.410	1.480	2.080	0.966	5.900
No. of Samples:		6	6	6	6	6	6	6
Mean+:		6.090	0.030	0.773	1.767	2.373	1.484	6.085
Median+:		6.215	0.030	0.855	1.800	2.315	1.545	5.195
390057	Kalamazoo River (Upper)							
7/18/2000		3.460	0.050	1.370	1.390	1.280	1.150	6.370
8/23/2000		MS 7.230	0.060	1.630	1.600	1.360	1.690	10.800
9/21/2000		2.380	0.020	0.740	0.960	2.000	0.693	5.700
No. of Samples:		3	3	3	3	3	3	3
Mean+:		4.357	0.043	1.247	1.317	1.547	1.178	7.623
Median+:		3.460	0.050	1.370	1.390	1.360	1.150	6.370
510088	Manistee River							
7/25/2000		0.630	0.004	0.250	0.340	1.380	0.126	0.710
8/29/2000		0.480	ELOD 0.005	0.210	0.350	0.860	0.111	0.730
9/25/2000		0.280	ISQC 0.000	0.210	0.240	1.100	0.072	0.380
No. of Samples:		3	3	3	3	3	3	3
Mean+:		0.463	0.003	0.223	0.310	1.113	0.103	0.607
Median+:		0.480	0.004	0.210	0.340	1.100	0.111	0.710
770073	Manistique River							
7/18/2000		1.520	0.008	0.300	0.340	0.450	0.091	0.480
8/17/2000		0.780	0.003	0.280	0.280	0.250	0.064	0.420
9/20/2000		MSD 0.900	0.020	0.220	0.310	ELOD 0.420	0.085	0.970
No. of Samples:		3	3	3	3	3	3	3
Mean+:		1.067	0.010	0.267	0.310	0.373	0.080	0.623
Median+:		0.900	0.008	0.280	0.310	0.420	0.085	0.480

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550038 Menominee River							
7/20/2000	4.640	0.008	0.340	1.010	0.880	0.179	0.880
8/16/2000	3.590	0.010	0.400	0.960	0.940	0.140	1.300
9/26/2000	2.010	ELOD 0.008	BSQC 0.310	0.780	0.680	0.134	BSQC 1.300
No. of Samples:	3	3	3	3	3	3	3
Mean+:	3.413	0.009	0.350	0.917	0.833	0.151	1.160
Median+:	3.590	0.008	0.340	0.960	0.880	0.140	1.300
610273 Muskegon River (Lower)							
7/12/2000	1.100	0.003	0.220	0.630	0.890	0.150	2.110
8/2/2000	1.370	0.006	CCB 0.300	0.680	1.580	0.223	0.830
8/30/2000	0.710	0.001	CCB 0.170	0.620	0.760	0.077	0.520
9/26/2000	0.370	ELOD 0.001	BSQC 0.100	0.590	0.830	0.120	BSQC 1.100
10/24/2000	1.040	0.010	0.120	0.370	0.950	0.093	0.950
11/14/2000	0.790	0.005	0.110	0.420	0.950	0.092	0.730
No. of Samples:	6	6	6	6	6	6	6
Mean+:	0.897	0.004	0.170	0.552	0.993	0.126	1.040
Median+:	0.915	0.004	0.145	0.605	0.920	0.107	0.890
670008 Muskegon River (Upper)							
7/24/2000	0.570	0.003	0.110	0.340	0.980	0.053	0.840
8/30/2000	0.590	0.004	CCB 0.260	CCB 0.480	0.810	0.137	0.980
9/25/2000	0.830	ISQC 0.004	0.260	0.360	1.070	0.147	0.870
No. of Samples:	3	3	3	3	3	3	3
Mean+:	0.663	0.004	0.210	0.393	0.953	0.112	0.897
Median+:	0.590	0.004	0.260	0.360	0.980	0.137	0.870
660038 Ontonagon River							
7/19/2000	2.210	0.009	0.650	2.740	0.730	0.134	0.960
8/15/2000	1.020	0.010	0.690	2.160	0.800	0.089	0.930
9/11/2000	0.640	ELOD 0.005	0.760	1.380	0.860	0.085	0.800
No. of Samples:	3	3	3	3	3	3	3
Mean+:	1.290	0.008	0.700	2.093	0.797	0.103	0.897
Median+:	1.020	0.009	0.690	2.160	0.800	0.089	0.930

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530027	Pere Marquette River							
7/12/2000		1.780	0.010	0.480	0.470	0.840	0.390	1.370
7/25/2000		1.380	0.020	0.370	0.700	3.190	0.322	6.260
8/2/2000		3.280	0.020	0.570	0.780	1.130	0.482	1.980
8/29/2000		1.520	ELOD 0.010	0.370	0.450	0.770	0.290	1.380
9/26/2000		1.250	ISQC 0.008	0.480	0.440	1.060	0.243	1.390
11/14/2000		1.260	0.004	0.260	0.510	0.820	0.140	0.920
No. of Samples:		6	6	6	6	6	6	6
Mean+:		1.745	0.012	0.422	0.558	1.302	0.311	2.217
Median+:		1.450	0.010	0.425	0.490	0.950	0.306	1.385
490006	Pine River (Mackinac Co.)							
7/13/2000		1.560	0.009	1.250	1.260	0.900	0.507	2.230
8/23/2000	MS	1.870	0.008	1.630	1.290	0.970	0.543	2.600
9/18/2000	MSD	1.430	0.010	1.450	1.180	0.960	0.420	2.020
No. of Samples:		3	3	3	3	3	3	3
Mean+:		1.620	0.009	1.443	1.243	0.943	0.490	2.283
Median+:		1.560	0.009	1.450	1.260	0.960	0.507	2.230
580046	River Raisin							
8/8/2000		5.680	0.030	1.370	4.180	3.210	1.160	SLRS 5.300
9/5/2000		1.400	0.020	0.680	2.710	2.800	0.776	22.100
9/21/2000		3.010	0.040	1.410	3.140	3.650	1.340	20.300
No. of Samples:		3	3	3	3	3	3	3
Mean+:		3.363	0.030	1.153	3.343	3.220	1.092	15.900
Median+:		3.010	0.030	1.370	3.140	3.210	1.160	20.300

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820070	River Rouge								
7/27/2000		4.550	0.060		1.920	3.020	2.610	2.120	12.200
7/31/2000		7.730	0.080		2.990	5.700	3.880	4.360	22.900
8/3/2000		15.200	0.160		4.380	7.210	4.440	7.090	28.800
8/30/2000		0.960	0.030		0.840	2.750	2.140	1.110	12.100
9/13/2000		6.190	0.080		2.570	5.090	3.550	3.170	14.300
11/29/2000		2.370	0.030		1.060	1.670	1.450	1.200	12.300
No. of Samples:		6	6		6	6	6	6	6
Mean+:		6.167	0.073		2.293	4.240	3.012	3.175	17.100
Median+:		5.370	0.070		2.245	4.055	3.080	2.645	13.300
730023	Shiawassee River								
7/26/2000		1.510	0.010		0.730	1.770	2.340	0.404	2.560
8/1/2000		5.330	0.040		1.790	3.230	3.030	2.380	6.790
8/22/2000		2.930	0.010		0.780	1.720	2.040	0.674	4.780
9/12/2000		2.060	0.020		0.900	1.800	2.440	0.817	3.480
9/28/2000		4.860	0.030	BSQC	2.700	3.120	2.310	2.040	BSQC 46.000
11/28/2000		0.650	0.020		0.440	1.300	2.160	0.209	2.630
No. of Samples:		6	6		6	6	6	6	6
Mean+:		2.890	0.022		1.223	2.157	2.387	1.087	11.040
Median+:		2.495	0.020		0.840	1.785	2.325	0.746	4.130
110628	St. Joseph River (Lower)								
7/18/2000		2.160	0.030		0.440	1.550	2.110	0.727	2.800
8/24/2000	MS	3.430	0.020	CCB	0.350	1.210	1.770	0.589	2.320
9/27/2000		3.200	0.030	BSQC	0.500	1.460	2.170	0.882	BSQC 14.000
No. of Samples:		3	3		3	3	3	3	3
Mean+:		2.930	0.027		0.430	1.407	2.017	0.733	6.373
Median+:		3.200	0.030		0.440	1.460	2.110	0.727	2.800

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750273 St. Joseph River (Upper)							
7/17/2000	1.160	0.009	0.210	0.660	1.620	0.317	1.220
8/1/2000	2.800	0.020	0.340	0.760	2.110	0.568	1.760
8/23/2000	MS 2.220	0.004	CCB 0.140	0.480	1.240	0.209	0.670
9/27/2000	1.220	ELOD 0.006	BSQC 0.120	0.540	1.590	0.272	BSQC 2.500
10/19/2000	1.190	0.010	0.160	0.500	1.560	0.276	1.470
11/15/2000	0.560	0.009	0.040	0.370	1.610	0.085	0.710
No. of Samples:	6	6	6	6	6	6	6
Mean+:	1.525	0.010	0.168	0.552	1.622	0.288	1.388
Median+:	1.205	0.009	0.150	0.520	1.600	0.274	1.345
210032 Sturgeon River (Delta Co.)							
7/26/2000	1.110	0.003	0.310	0.360	0.520	0.054	1.420
8/29/2000	1.600	0.001	CCB 0.280	CCB 0.470	0.320	0.036	0.510
9/25/2000	1.880	0.006	0.460	0.290	0.230	0.167	1.250
No. of Samples:	3	3	3	3	3	3	3
Mean+:	1.530	0.003	0.350	0.373	0.357	0.086	1.060
Median+:	1.600	0.003	0.310	0.360	0.320	0.054	1.250
170141 Tahquamenon River							
7/18/2000	3.000	0.007	0.360	0.950	0.430	0.142	0.680
8/14/2000	1.010	0.007	0.290	0.840	0.490	0.032	0.520
9/12/2000	0.660	0.001	0.240	0.260	ELOD 0.350	0.031	0.300
No. of Samples:	3	3	3	3	3	3	3
Mean+:	1.557	0.005	0.297	0.683	0.423	0.068	0.500
Median+:	1.010	0.007	0.290	0.840	0.430	0.032	0.520

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040123 Thunder Bay River							
7/12/2000	0.400	0.001	CCB 0.140	0.430	1.310	0.098	0.610
8/2/2000	0.500	0.001	0.050	0.430	1.010	0.080	0.310
8/10/2000	0.630	0.002	0.090	0.290	0.910	0.106	0.290
8/21/2000	0.420	0.000	0.120	0.510	0.770	0.097	0.380
9/19/2000	MSD 0.210	0.002	ELOD 0.040	0.260	0.950	0.110	0.290
11/27/2000	0.620	0.007	0.100	0.280	0.860	0.053	0.560
No. of Samples:	6	6	6	6	6	6	6
Mean+:	0.463	0.002	0.090	0.367	0.968	0.091	0.407
Median+:	0.460	0.002	0.095	0.360	0.930	0.098	0.345
730025 Tittabawassee River							
7/19/2000	1.760	0.010	0.400	1.440	2.400	0.228	2.000
8/14/2000	1.160	0.007	0.430	1.690	2.230	0.199	1.700
9/12/2000	1.780	0.020	0.670	1.600	1.760	0.567	2.850
No. of Samples:	3	3	3	3	3	3	3
Mean+:	1.567	0.012	0.500	1.577	2.130	0.331	2.183
Median+:	1.760	0.010	0.430	1.600	2.230	0.228	2.000

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STORET ID		Cong. 8+5 (ng/L)	Cong. 82 (ng/L)	Cong. 83 (ng/L)	Cong. 85 (ng/L)	Cong. 87 (ng/L)	Cong. 89 (ng/L)	Cong. 91 (ng/L)	Cong. 92+84 (ng/L)	Cong. 95 (ng/L)	Cong. 97 (ng/L)	Cong. 99 (ng/L)
350061	Au Sable River											
	8/22/2000	0.062	0.001	0.000	0.000	0.006	0.000	0.001	0.000	0.007	0.001	0.002
740385	Black River (St. Clair Co.)											
	7/26/2000	0.205	0.012	0.004	0.016	0.029	0.007	0.011	NAI	0.069	0.019	0.022
730024	Cass River											
	8/15/2000	0.185	0.006	0.003	0.011	0.022	0.006	0.007	0.008	0.063	0.011	0.016
160073	Cheboygan River											
	8/1/2000	0.115	0.000	0.000	0.000	NAI	0.002	0.003	0.000	NAI	0.002	0.004
500233	Clinton River											
	9/13/2000	NAI	0.048	0.018	0.049	0.132	0.031	0.060	NAI	0.322	0.057	0.083
210102	Escanaba River											
	7/25/2000	0.105	0.000	0.000	0.000	0.012	0.000	0.003	0.000	0.012	0.000	0.006
730285	Flint River											
	9/6/2000	NAI	0.010	0.002	0.010	0.023	0.003	0.010	NAI	0.083	0.009	0.016
700123	Grand River (Lower)											
	10/23/2000	0.062	NAI	0.003	0.009	0.016	0.015	0.008	NAI	0.047	0.008	0.013
340025	Grand River (Upper)											
	7/24/2000	NAI	0.021	0.000	NAI	NAI	0.013	0.013	NAI	0.068	0.025	0.041
580364	Huron River											
	9/5/2000	0.182	0.021	0.010	0.027	0.056	0.033	0.018	NAI	0.108	0.020	0.047
030077	Kalamazoo River (Lower)											
	8/10/2000	0.560	0.060	0.062	0.135	0.183	0.014	0.147	0.600	0.597	0.145	0.269
390057	Kalamazoo River (Upper)											
	8/23/2000	NAI	0.054	0.031	0.080	0.157	0.022	0.052	0.354	0.322	0.090	0.121
510088	Manistee River											
	8/29/2000	0.227	0.004	0.000	0.006	0.016	0.003	0.003	NAI	0.026	0.006	0.010

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STORET ID		Cong. 24+27 (ng/L)	Cong. 25 (ng/L)	Cong. 26 (ng/L)	Cong. 28+31 (ng/L)	Cong. 3 (ng/L)	Cong. 33 (ng/L)	Cong. 37+42 (ng/L)	Cong. 4+10 (ng/L)	Cong. 40 (ng/L)	Cong. 41+71+64 (ng/L)	Cong. 44 (ng/L)	Cong. 45 (ng/L)	Cong. 46 (ng/L)
350061	Au Sable River													
	8/22/2000	0.002	0.000	0.000	0.037	0.000	0.008	0.000	0.015	0.000	0.007	0.009	0.001	0.002
740385	Black River (St. Clair Co.)													
	7/26/2000	0.005	0.011	NAI	0.123	0.000	0.024	NAI	0.061	0.026	0.067	0.072	0.013	0.006
730024	Cass River													
	8/15/2000	0.004	0.004	0.000	0.098	0.000	0.031	NAI	0.044	0.013	0.035	0.035	0.007	0.003
160073	Cheboygan River													
	8/1/2000	0.004	0.003	0.000	0.071	0.000	0.016	NAI	0.041	0.006	0.013	0.017	0.003	0.003
500233	Clinton River													
	9/13/2000	0.032	0.013	NAI	0.501	NAI	0.123	NAI	0.088	0.060	0.184	0.170	0.026	0.013
210102	Escanaba River													
	7/25/2000	0.003	0.000	NAI	0.054	0.000	0.006	NAI	0.026	0.000	0.009	0.026	0.000	0.000
730285	Flint River													
	9/6/2000	0.004	0.010	0.000	0.102	0.000	0.021	NAI	0.038	NAI	0.035	0.089	0.007	0.005
700123	Grand River (Lower)													
	10/23/2000	NAI	0.000	0.000	0.032	0.000	0.006	NAI	0.032	NAI	0.030	0.016	0.001	0.002
340025	Grand River (Upper)													
	7/24/2000	NAI	NAI	0.000	0.131	0.000	0.031	NAI	0.022	0.014	0.058	0.081	0.005	0.000
580364	Huron River													
	9/5/2000	0.007	0.008	NAI	0.210	0.000	0.051	NAI	0.041	NAI	0.093	0.084	0.010	0.005
030077	Kalamazoo River (Lower)													
	8/10/2000	0.053	0.107	0.229	1.717	NDD	0.161	0.466	0.126	0.159	0.632	0.665	0.139	0.074
390057	Kalamazoo River (Upper)													
	8/23/2000	0.017	0.020	0.008	0.094	NAI	0.082	0.065	0.042	0.042	0.109	0.144	0.000	0.000
510088	Manistee River													
	8/29/2000	0.007	0.006	0.004	0.097	0.000	0.030	NAI	0.041	0.000	0.018	0.032	0.003	0.002

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STORET ID		Cong. 47+48 (ng/L)	Cong. 49 (ng/L)	Cong. 51 (ng/L)	Cong. 52 (ng/L)	Cong. 53 (ng/L)	Cong. 56+60 (ng/L)	Cong. 6 (ng/L)	Cong. 63 (ng/L)	Cong. 66 (ng/L)	Cong. 7+9 (ng/L)	Cong. 70+76 (ng/L)	Cong. 74 (ng/L)	Cong. 77+110 (ng/L)
350061	Au Sable River													
	8/22/2000	0.011	NAI	0.015	0.016	0.000	0.002	0.004	0.000	0.007	0.006	0.008	0.002	0.008
740385	Black River (St. Clair Co.)													
	7/26/2000	0.034	NAI	0.005	NAI	0.000	0.044	0.027	0.000	0.103	0.113	0.059	0.028	0.069
730024	Cass River													
	8/15/2000	0.019	0.069	0.004	NAI	0.000	0.022	0.016	0.003	0.074	NAI	0.020	0.016	0.049
160073	Cheboygan River													
	8/1/2000	0.023	NAI	0.039	0.037	NAI	0.005	0.006	0.000	0.008	0.009	0.013	0.004	0.015
500233	Clinton River													
	9/13/2000	0.086	NAI	0.010	0.681	NAI	0.150	0.056	0.007	0.261	NAI	0.169	0.090	0.491
210102	Escanaba River													
	7/25/2000	0.017	NAI	0.022	0.029	0.000	0.004	0.008	0.000	0.008	0.009	0.012	0.000	0.021
730285	Flint River													
	9/6/2000	0.007	NAI	0.002	0.111	NAI	0.018	NAI	0.000	0.067	NAI	0.038	0.014	0.085
700123	Grand River (Lower)													
	10/23/2000	0.008	NAI	0.003	0.183	0.000	0.006	0.029	0.000	0.024	0.004	0.064	0.004	0.055
340025	Grand River (Upper)													
	7/24/2000	0.000	NAI	0.000	NAI	NAI	0.025	0.080	0.004	0.033	0.012	0.036	NAI	0.170
580364	Huron River													
	9/5/2000	0.037	NAI	0.004	0.192	NAI	0.064	0.013	0.002	0.132	NAI	0.108	0.045	0.170
030077	Kalamazoo River (Lower)													
	8/10/2000	0.415	0.634	0.036	1.022	0.063	0.319	0.094	0.037	0.866	0.046	0.346	0.199	0.741
390057	Kalamazoo River (Upper)													
	8/23/2000	0.056	NAI	0.006	0.275	NAI	0.070	NAI	0.000	0.155	0.016	0.148	0.055	0.494
510088	Manistee River													
	8/29/2000	0.008	NAI	0.000	0.039	NAI	0.009	0.011	0.000	0.021	NAI	0.024	0.012	0.033

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STORET ID		Cong. 101 (ng/L)	Cong. 118 (ng/L)	Cong. 123+149 (ng/L)	Cong. 128 (ng/L)	Cong. 132+153+105 (ng/L)	Cong. 135+144 (ng/L)	Cong. 136 (ng/L)	Cong. 137+176 (ng/L)	Cong. 141 (ng/L)	Cong. 146 (ng/L)	Cong. 15+17 (ng/L)	Cong. 151 (ng/L)
350061	Au Sable River												
	8/22/2000	0.006	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.001	NAI	0.026	0.000
740385	Black River (St. Clair Co.)												
	7/26/2000	0.040	0.033	0.014	0.007	0.035	0.006	0.000	0.000	0.006	NAI	0.054	0.004
730024	Cass River												
	8/15/2000	0.032	0.026	0.016	0.008	0.041	0.006	0.000	0.000	0.004	NAI	0.046	0.004
160073	Cheboygan River												
	8/1/2000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	NAI	0.047	0.000
500233	Clinton River												
	9/13/2000	0.189	0.204	0.258	0.087	0.485	0.078	0.040	0.005	0.069	NAI	0.088	0.084
210102	Escanaba River												
	7/25/2000	0.005	0.000	0.000	0.000	NAI	0.000	0.000	0.000	0.000	NAI	0.050	0.000
730285	Flint River												
	9/6/2000	0.044	0.023	0.031	0.016	NAI	0.015	0.006	0.001	0.009	NAI	0.042	0.010
700123	Grand River (Lower)												
	10/23/2000	0.031	0.022	0.022	0.010	0.047	NAI	0.000	0.000	0.006	0.011	0.018	0.005
340025	Grand River (Upper)												
	7/24/2000	0.028	0.053	0.050	0.016	0.122	0.027	0.000	0.000	0.012	0.019	0.038	0.011
580364	Huron River												
	9/5/2000	0.123	0.099	0.052	0.026	0.137	0.021	0.000	0.001	0.017	0.040	0.054	0.016
030077	Kalamazoo River (Lower)												
	8/10/2000	0.563	0.369	0.225	0.088	0.482	0.081	0.051	NDD	0.052	0.096	0.594	0.069
390057	Kalamazoo River (Upper)												
	8/23/2000	0.265	0.235	0.161	0.086	0.382	0.052	0.015	0.002	0.048	0.049	0.044	0.045
510088	Manistee River												
	8/29/2000	0.018	0.009	0.006	0.003	0.025	0.002	0.000	0.000	0.003	NAI	0.037	0.002

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STORET ID		Cong. 158 (ng/L)	Cong. 16+32 (ng/L)	Cong. 163+138 (ng/L)	Cong. 167 (ng/L)	Cong. 170+190 (ng/L)	Cong. 172 (ng/L)	Cong. 174 (ng/L)	Cong. 177 (ng/L)	Cong. 178 (ng/L)	Cong. 18 (ng/L)	Cong. 180 (ng/L)	Cong. 183 (ng/L)	Cong. 185 (ng/L)
350061	Au Sable River													
	8/22/2000	0.000	0.019	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000
740385	Black River (St. Clair Co.)													
	7/26/2000	0.006	0.053	0.038	0.000	0.005	0.000	0.005	0.005	0.000	0.060	0.010	0.003	0.000
730024	Cass River													
	8/15/2000	0.006	0.043	0.043	0.005	0.006	0.000	0.007	0.006	0.002	0.052	0.013	0.003	0.000
160073	Cheboygan River													
	8/1/2000	0.000	0.037	0.020	0.000	NAI	0.000	0.000	0.001	0.000	0.028	0.000	0.000	0.000
500233	Clinton River													
	9/13/2000	0.087	0.194	0.564	0.031	0.156	0.042	0.127	0.087	0.036	0.195	0.284	0.064	0.014
210102	Escanaba River													
	7/25/2000	0.000	0.037	0.018	0.000	0.005	0.000	0.000	0.015	0.000	0.028	0.000	0.000	0.000
730285	Flint River													
	9/6/2000	0.011	0.063	0.085	0.006	0.014	0.004	0.016	0.012	0.005	0.035	0.029	0.008	0.001
700123	Grand River (Lower)													
	10/23/2000	0.012	0.016	0.049	0.004	0.010	0.002	0.018	0.004	0.004	0.020	0.012	0.003	0.003
340025	Grand River (Upper)													
	7/24/2000	0.017	0.019	0.118	0.008	0.028	0.005	0.025	0.019	0.006	NAI	0.037	0.012	0.004
580364	Huron River													
	9/5/2000	0.023	0.063	0.150	0.008	0.029	0.007	0.021	0.017	0.008	0.047	0.050	0.013	0.002
030077	Kalamazoo River (Lower)													
	8/10/2000	0.058	0.404	0.479	0.024	0.063	0.018	0.062	0.051	0.023	0.520	0.119	0.039	0.006
390057	Kalamazoo River (Upper)													
	8/23/2000	0.066	0.116	0.446	0.027	0.066	0.017	0.045	0.042	0.015	0.058	0.106	0.023	0.004
510088	Manistee River													
	8/29/2000	0.000	0.036	0.020	0.002	0.002	0.000	0.002	0.000	0.002	0.046	0.004	0.001	0.000

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STORET ID		Cong. 187+182 (ng/L)	Cong. 19 (ng/L)	Cong. 193 (ng/L)	Cong. 194 (ng/L)	Cong. 198 (ng/L)	Cong. 199 (ng/L)	Cong. 201 (ng/L)	Cong. 202+171 (ng/L)	Cong. 203+196 (ng/L)	Cong. 206 (ng/L)	Cong. 207 (ng/L)	Cong. 208+195 (ng/L)	Cong. 22 (ng/L)
350061	Au Sable River													
	8/22/2000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006
740385	Black River (St. Clair Co.)													
	7/26/2000	0.006	0.000	0.000	0.004	0.000	0.000	0.009	0.002	0.006	0.003	0.000	0.003	0.049
730024	Cass River													
	8/15/2000	0.007	0.000	0.000	0.005	0.000	0.000	0.010	0.003	0.009	0.003	0.000	0.003	0.045
160073	Cheboygan River													
	8/1/2000	0.000	0.003	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.011
500233	Clinton River													
	9/13/2000	0.116	0.059	0.025	0.079	0.003	0.007	0.130	0.034	0.150	0.041	0.005	0.036	0.271
210102	Escanaba River													
	7/25/2000	0.000	0.004	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.050
730285	Flint River													
	9/6/2000	0.014	NAI	0.004	0.011	0.000	0.001	0.021	0.005	0.016	0.008	0.000	0.005	0.024
700123	Grand River (Lower)													
	10/23/2000	0.007	0.003	0.002	0.004	0.000	0.001	0.007	0.002	0.007	0.004	0.000	0.003	0.018
340025	Grand River (Upper)													
	7/24/2000	0.025	NAI	0.000	0.009	0.002	0.000	0.015	0.007	0.026	0.005	0.000	0.006	NAI
580364	Huron River													
	9/5/2000	0.025	NAI	0.005	0.016	0.000	0.002	0.032	0.007	0.032	0.012	0.001	0.008	0.055
030077	Kalamazoo River (Lower)													
	8/10/2000	0.069	0.024	0.011	0.031	0.000	0.005	0.061	0.018	0.057	0.022	NDD	0.016	0.231
390057	Kalamazoo River (Upper)													
	8/23/2000	0.055	0.035	0.009	0.029	0.000	0.003	0.050	0.014	0.052	0.020	0.002	0.015	0.128
510088	Manistee River													
	8/29/2000	0.004	0.003	0.000	0.002	0.000	0.000	0.000	0.001	0.003	0.001	0.000	0.001	0.045

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STORET ID		Cong. 8+5 (ng/L)	Cong. 82 (ng/L)	Cong. 83 (ng/L)	Cong. 85 (ng/L)	Cong. 87 (ng/L)	Cong. 89 (ng/L)	Cong. 91 (ng/L)	Cong. 92+84 (ng/L)	Cong. 95 (ng/L)	Cong. 97 (ng/L)	Cong. 99 (ng/L)
770073	Manistique River											
	8/17/2000	0.064	0.003	0.001	0.006	0.019	0.000	0.004	NAI	0.027	0.006	0.010
550038	Menominee River											
	9/26/2000	0.046	0.002	0.000	0.004	0.009	0.001	0.002	0.000	0.013	0.003	0.005
610273	Muskegon River (Lower)											
	8/30/2000	0.153	0.002	0.001	0.005	0.011	0.003	0.004	NAI	0.028	0.004	0.007
670008	Muskegon River (Upper)											
	9/25/2000	0.166	0.006	0.000	0.003	0.012	0.002	0.002	NAI	0.018	0.004	0.006
660038	Ontonagon River											
	8/15/2000	0.092	0.001	0.000	0.000	0.007	0.001	0.000	0.000	0.003	0.001	0.002
530027	Pere Marquette River											
	9/26/2000	0.095	0.007	0.002	0.010	0.012	0.002	0.003	NAI	0.018	0.006	0.013
490006	Pine River (Mackinac Co.)											
	8/23/2000	0.134	0.002	0.001	0.003	0.007	0.000	0.002	0.000	0.019	0.002	0.004
580046	River Raisin											
	8/8/2000	0.708	0.093	0.027	0.156	0.222	0.036	0.122	0.415	0.341	0.118	0.177
820070	River Rouge											
	7/27/2000	2.137	0.240	0.228	0.304	0.761	0.127	0.396	2.141	1.715	0.545	0.548
730023	Shiawassee River											
	9/12/2000	0.219	NAI	0.004	0.017	0.035	0.013	0.008	NAI	0.056	0.013	0.023
110628	St. Joseph River (Lower)											
	8/24/2000	0.135	0.006	0.006	0.016	0.034	0.007	0.011	0.080	0.081	0.017	0.023
750273	St. Joseph River (Upper)											
	7/17/2000	0.207	0.003	0.003	0.008	0.016	0.003	0.009	0.043	0.048	0.009	0.012
210032	Sturgeon River (Delta Co.)											
	8/29/2000	0.063	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.005	0.001	0.002

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STORET ID		Cong. 24+27 (ng/L)	Cong. 25 (ng/L)	Cong. 26 (ng/L)	Cong. 28+31 (ng/L)	Cong. 3 (ng/L)	Cong. 33 (ng/L)	Cong. 37+42 (ng/L)	Cong. 4+10 (ng/L)	Cong. 40 (ng/L)	Cong. 41+71+64 (ng/L)	Cong. 44 (ng/L)	Cong. 45 (ng/L)	Cong. 46 (ng/L)
770073	Manistique River													
	8/17/2000	0.002	0.000	0.000	0.039	0.000	0.007	NAI	0.014	0.003	0.009	0.015	0.002	0.003
550038	Menominee River													
	9/26/2000	0.001	0.000	0.000	0.026	0.000	NAI	0.007	0.018	0.000	0.007	0.010	0.000	0.002
610273	Muskegon River (Lower)													
	8/30/2000	0.003	0.003	NAI	0.082	0.000	0.029	NAI	0.024	NAI	0.019	0.025	0.004	0.002
670008	Muskegon River (Upper)													
	9/25/2000	0.000	0.000	NAI	0.059	0.000	0.026	NAI	0.030	0.000	0.012	0.024	0.000	0.001
660038	Ontonagon River													
	8/15/2000	0.002	0.003	NAI	0.050	0.000	0.009	NAI	0.028	0.000	0.009	0.011	0.002	0.002
530027	Pere Marquette River													
	9/26/2000	NAI	0.003	NAI	0.040	0.000	0.009	NAI	0.025	0.000	0.013	0.017	0.001	0.002
490006	Pine River (Mackinac Co.)													
	8/23/2000	0.003	0.006	0.006	0.077	0.000	0.023	NAI	0.036	0.000	0.016	0.025	0.003	0.003
580046	River Raisin													
	8/8/2000	0.180	0.582	0.688	2.031	NDD	0.116	0.516	0.310	0.249	0.887	0.943	0.121	0.068
820070	River Rouge													
	7/27/2000	0.176	0.508	0.317	5.521	NAI	1.080	2.608	0.643	0.604	2.211	2.035	0.472	0.127
730023	Shiawassee River													
	9/12/2000	0.012	0.006	NAI	0.160	0.000	0.035	NAI	0.062	NAI	0.052	0.042	0.005	0.003
110628	St. Joseph River (Lower)													
	8/24/2000	0.006	NAI	NAI	0.087	0.000	0.016	0.078	0.028	0.012	0.033	0.037	0.004	0.003
750273	St. Joseph River (Upper)													
	7/17/2000	0.006	0.010	NAI	0.112	0.000	0.035	NAI	0.066	0.012	0.040	0.066	0.006	0.006
210032	Sturgeon River (Delta Co.)													
	8/29/2000	0.001	0.000	0.000	0.029	0.000	0.005	0.000	0.010	NAI	0.006	0.009	0.001	0.002

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STORET ID		Cong. 47+48 (ng/L)	Cong. 49 (ng/L)	Cong. 51 (ng/L)	Cong. 52 (ng/L)	Cong. 53 (ng/L)	Cong. 56+60 (ng/L)	Cong. 6 (ng/L)	Cong. 63 (ng/L)	Cong. 66 (ng/L)	Cong. 7+9 (ng/L)	Cong. 70+76 (ng/L)	Cong. 74 (ng/L)	Cong. 77+110 (ng/L)
770073	Manistique River													
	8/17/2000	0.012	NAI	0.016	0.040	0.000	0.003	0.004	0.000	0.011	0.004	0.012	0.003	0.038
550038	Menominee River													
	9/26/2000	0.010	0.011	0.009	0.020	0.000	0.006	0.005	0.000	0.009	0.003	0.010	0.002	0.019
610273	Muskegon River (Lower)													
	8/30/2000	0.012	NAI	0.002	0.044	0.000	0.009	0.010	0.000	0.022	NAI	0.021	0.007	0.027
670008	Muskegon River (Upper)													
	9/25/2000	0.006	NAI	0.001	0.031	0.000	0.006	NAI	0.000	0.012	0.009	0.027	0.007	0.022
660038	Ontonagon River													
	8/15/2000	0.012	NAI	0.025	0.014	0.000	0.003	0.006	0.000	0.003	0.008	0.007	0.004	0.005
530027	Pere Marquette River													
	9/26/2000	0.010	NAI	0.002	0.031	0.000	0.007	0.000	0.000	0.026	0.006	0.026	0.009	0.031
490006	Pine River (Mackinac Co.)													
	8/23/2000	0.026	0.016	0.021	0.028	NAI	0.005	0.011	0.000	0.016	0.020	0.015	0.008	0.016
580046	River Raisin													
	8/8/2000	0.519	0.989	0.050	1.134	0.032	0.437	0.249	0.061	0.947	0.055	0.485	0.326	0.629
820070	River Rouge													
	7/27/2000	1.307	1.367	0.135	3.137	0.389	1.698	NAI	0.132	2.961	NAI	1.984	0.906	2.512
730023	Shiawassee River													
	9/12/2000	0.023	NAI	0.003	0.100	0.000	0.032	0.029	0.002	0.059	0.041	0.083	0.028	0.079
110628	St. Joseph River (Lower)													
	8/24/2000	0.021	0.022	0.004	0.103	NAI	0.019	0.008	0.000	0.058	0.011	0.026	0.015	0.103
750273	St. Joseph River (Upper)													
	7/17/2000	0.018	0.049	0.008	0.088	NAI	0.022	0.000	0.000	0.046	0.020	0.033	0.014	0.045
210032	Sturgeon River (Delta Co.)													
	8/29/2000	0.008	0.005	0.008	0.011	0.000	0.001	0.009	0.000	0.005	0.010	0.005	0.002	0.005

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STORET ID		Cong. 101 (ng/L)	Cong. 118 (ng/L)	Cong. 123+149 (ng/L)	Cong. 128 (ng/L)	Cong. 132+153+105 (ng/L)	Cong. 135+144 (ng/L)	Cong. 136 (ng/L)	Cong. 137+176 (ng/L)	Cong. 141 (ng/L)	Cong. 146 (ng/L)	Cong. 15+17 (ng/L)	Cong. 151 (ng/L)
770073	Manistique River												
	8/17/2000	0.030	0.018	0.007	0.005	0.022	0.003	0.000	0.000	0.002	NAI	0.027	0.002
550038	Menominee River												
	9/26/2000	0.017	0.009	0.007	0.004	0.021	0.003	0.000	0.000	0.003	0.004	0.018	0.002
610273	Muskegon River (Lower)												
	8/30/2000	0.022	0.009	0.007	0.002	0.016	0.003	0.000	0.000	0.002	NAI	0.039	0.002
670008	Muskegon River (Upper)												
	9/25/2000	0.019	0.005	0.005	0.002	0.017	0.003	0.000	0.000	0.003	NAI	0.034	0.002
660038	Ontonagon River												
	8/15/2000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	NAI	0.039	0.000
530027	Pere Marquette River												
	9/26/2000	0.023	0.019	0.012	0.007	0.041	0.005	0.000	0.000	0.005	NAI	0.021	0.004
490006	Pine River (Mackinac Co.)												
	8/23/2000	0.012	0.007	0.003	0.002	NAI	0.001	0.000	0.000	0.001	NAI	0.058	0.001
580046	River Raisin												
	8/8/2000	0.170	0.276	0.078	0.026	0.266	0.029	0.012	0.002	0.026	0.046	0.665	0.026
820070	River Rouge												
	7/27/2000	1.782	1.292	1.683	0.306	3.345	0.622	0.124	0.049	0.583	0.509	1.176	0.699
730023	Shiawassee River												
	9/12/2000	0.049	0.032	0.017	0.009	0.047	0.009	0.000	0.000	0.007	NAI	0.061	0.006
110628	St. Joseph River (Lower)												
	8/24/2000	0.073	0.047	0.036	0.015	0.076	0.013	0.000	0.000	0.009	0.043	0.041	0.011
750273	St. Joseph River (Upper)												
	7/17/2000	0.034	0.015	0.012	0.005	0.024	0.005	0.000	0.000	0.004	0.022	0.060	0.004
210032	Sturgeon River (Delta Co.)												
	8/29/2000	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.001	NAI	0.022	0.000

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STORET ID		Cong. 158 (ng/L)	Cong. 16+32 (ng/L)	Cong. 163+138 (ng/L)	Cong. 167 (ng/L)	Cong. 170+190 (ng/L)	Cong. 172 (ng/L)	Cong. 174 (ng/L)	Cong. 177 (ng/L)	Cong. 178 (ng/L)	Cong. 18 (ng/L)	Cong. 180 (ng/L)	Cong. 183 (ng/L)	Cong. 185 (ng/L)
770073	Manistique River													
	8/17/2000	0.003	0.019	0.030	0.000	0.000	0.000	0.001	0.001	0.000	0.017	0.002	0.000	0.000
550038	Menominee River													
	9/26/2000	0.003	0.014	0.024	0.001	0.005	0.001	0.004	0.005	0.001	0.012	0.008	0.002	0.000
610273	Muskegon River (Lower)													
	8/30/2000	0.002	0.037	0.014	0.001	0.003	0.000	0.003	0.003	0.001	0.033	0.006	0.002	0.000
670008	Muskegon River (Upper)													
	9/25/2000	0.002	0.034	0.012	0.000	0.002	0.000	0.002	0.001	0.001	0.032	0.002	0.001	0.000
660038	Ontonagon River													
	8/15/2000	0.000	0.027	0.010	0.000	0.000	0.000	0.001	0.001	0.000	0.022	0.001	0.000	0.000
530027	Pere Marquette River													
	9/26/2000	0.004	0.028	0.045	0.002	0.007	0.003	0.005	0.006	0.004	0.021	0.012	0.005	0.000
490006	Pine River (Mackinac Co.)													
	8/23/2000	0.000	0.039	0.010	0.001	0.001	0.000	0.002	0.001	0.000	0.033	0.002	0.000	0.000
580046	River Raisin													
	8/8/2000	0.027	0.604	0.185	0.011	0.052	0.015	0.042	0.030	0.015	0.794	0.091	0.020	0.003
820070	River Rouge													
	7/27/2000	0.436	3.378	3.256	0.164	1.460	0.274	1.120	0.736	0.325	1.049	2.257	0.477	0.120
730023	Shiawassee River													
	9/12/2000	0.009	0.050	0.047	0.004	0.008	0.001	0.007	0.005	0.003	0.048	0.011	0.003	0.001
110628	St. Joseph River (Lower)													
	8/24/2000	0.012	0.035	0.084	0.005	0.011	0.003	0.012	0.012	0.004	0.033	0.023	0.008	0.002
750273	St. Joseph River (Upper)													
	7/17/2000	0.003	0.060	0.024	0.000	0.003	0.000	0.004	0.004	0.000	0.049	0.007	0.002	0.000
210032	Sturgeon River (Delta Co.)													
	8/29/2000	0.000	0.015	0.004	0.000	0.000	0.000	0.001	0.000	0.000	0.013	0.000	0.000	0.000

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STORET ID		Cong. 187+182 (ng/L)	Cong. 19 (ng/L)	Cong. 193 (ng/L)	Cong. 194 (ng/L)	Cong. 198 (ng/L)	Cong. 199 (ng/L)	Cong. 201 (ng/L)	Cong. 202+171 (ng/L)	Cong. 203+196 (ng/L)	Cong. 206 (ng/L)	Cong. 207 (ng/L)	Cong. 208+195 (ng/L)	Cong. 22 (ng/L)
770073	Manistique River													
	8/17/2000	0.001	0.002	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.006
550038	Menominee River													
	9/26/2000	0.005	0.003	0.002	0.002	0.000	0.000	0.003	0.001	0.003	0.001	0.000	0.002	0.005
610273	Muskegon River (Lower)													
	8/30/2000	0.003	NAI	0.000	0.003	0.000	0.000	0.000	0.001	0.005	0.001	0.000	0.000	0.022
670008	Muskegon River (Upper)													
	9/25/2000	0.002	0.004	0.000	0.002	0.000	0.000	0.004	0.001	0.004	0.001	0.000	0.001	0.018
660038	Ontonagon River													
	8/15/2000	0.001	0.003	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.007
530027	Pere Marquette River													
	9/26/2000	0.009	0.004	0.002	0.003	0.000	0.000	0.013	0.003	0.008	0.002	0.000	0.002	0.012
490006	Pine River (Mackinac Co.)													
	8/23/2000	0.002	0.000	0.000	0.001	0.000	0.000	0.008	0.001	0.000	0.000	0.000	0.001	0.014
580046	River Raisin													
	8/8/2000	0.051	NAI	0.005	0.028	0.003	NDD	0.047	0.011	0.051	0.016	0.003	0.014	0.767
820070	River Rouge													
	7/27/2000	1.083	0.128	0.219	0.589	0.027	0.078	0.938	0.264	1.068	0.184	NAI	0.252	1.107
730023	Shiawassee River													
	9/12/2000	0.006	NAI	0.002	0.004	0.000	0.001	0.012	0.003	0.006	0.003	0.000	0.003	0.049
110628	St. Joseph River (Lower)													
	8/24/2000	0.013	0.005	0.002	0.008	0.003	0.000	0.019	0.006	0.020	0.007	0.000	0.005	0.025
750273	St. Joseph River (Upper)													
	7/17/2000	0.005	0.000	0.000	0.003	0.000	0.000	0.005	0.002	0.006	0.003	0.000	0.002	0.030
210032	Sturgeon River (Delta Co.)													
	8/29/2000	0.001	NAI	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.006

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STORET ID		Cong. 8+5 (ng/L)	Cong. 82 (ng/L)	Cong. 83 (ng/L)	Cong. 85 (ng/L)	Cong. 87 (ng/L)	Cong. 89 (ng/L)	Cong. 91 (ng/L)	Cong. 92+84 (ng/L)	Cong. 95 (ng/L)	Cong. 97 (ng/L)	Cong. 99 (ng/L)
170141	Tahquamenon River											
	9/12/2000	0.075	0.000	0.000	0.000	0.005	0.002	0.002	0.006	0.008	0.001	0.002
040123	Thunder Bay River											
	8/2/2000	0.113	0.003	0.002	0.004	0.018	0.002	0.004	NAI	NAI	0.005	0.009
730025	Tittabawassee River											
	8/14/2000	0.222	0.004	0.005	0.009	0.020	0.026	0.008	0.010	0.055	0.007	0.014

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STORET ID		Cong. 24+27 (ng/L)	Cong. 25 (ng/L)	Cong. 26 (ng/L)	Cong. 28+31 (ng/L)	Cong. 3 (ng/L)	Cong. 33 (ng/L)	Cong. 37+42 (ng/L)	Cong. 4+10 (ng/L)	Cong. 40 (ng/L)	Cong. 41+71+64 (ng/L)	Cong. 44 (ng/L)	Cong. 45 (ng/L)	Cong. 46 (ng/L)
170141	Tahquamenon River													
	9/12/2000	0.002	0.000	0.000	0.035	0.000	0.014	0.013	0.021	NAI	0.007	0.012	0.000	0.002
040123	Thunder Bay River													
	8/2/2000	0.004	0.003	0.000	0.078	0.000	0.021	NAI	0.035	NAI	0.016	0.021	0.002	0.003
730025	Tittabawassee River													
	8/14/2000	0.013	0.006	NAI	0.138	0.000	0.034	NAI	0.082	0.014	0.041	0.052	0.000	0.006

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STORET ID		Cong. 47+48 (ng/L)	Cong. 49 (ng/L)	Cong. 51 (ng/L)	Cong. 52 (ng/L)	Cong. 53 (ng/L)	Cong. 56+60 (ng/L)	Cong. 6 (ng/L)	Cong. 63 (ng/L)	Cong. 66 (ng/L)	Cong. 7+9 (ng/L)	Cong. 70+76 (ng/L)	Cong. 74 (ng/L)	Cong. 77+110 (ng/L)
170141	Tahquamenon River													
	9/12/2000	0.014	0.010	0.012	0.020	0.000	0.003	0.008	0.000	0.009	0.004	NAI	0.001	0.007
040123	Thunder Bay River													
	8/2/2000	0.023	NAI	0.038	0.053	NAI	0.007	0.005	0.000	0.012	0.008	0.021	0.005	0.029
730025	Tittabawassee River													
	8/14/2000	0.025	0.052	0.004	NAI	NAI	0.027	0.014	0.003	0.071	0.045	0.083	0.016	0.046

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NDD = Not detected due to dilution.

STORET ID		Cong. 101 (ng/L)	Cong. 118 (ng/L)	Cong. 123+149 (ng/L)	Cong. 128 (ng/L)	Cong. 132+153+105 (ng/L)	Cong. 135+144 (ng/L)	Cong. 136 (ng/L)	Cong. 137+176 (ng/L)	Cong. 141 (ng/L)	Cong. 146 (ng/L)	Cong. 15+17 (ng/L)	Cong. 151 (ng/L)
170141	Tahquamenon River												
	9/12/2000	0.008	0.000	0.000	0.000	0.003	0.001	0.000	0.000	0.001	0.002	0.026	0.000
040123	Thunder Bay River												
	8/2/2000	0.027	0.006	0.003	0.002	0.013	0.002	0.000	0.000	0.003	NAI	0.046	0.002
730025	Tittabawassee River												
	8/14/2000	0.044	0.020	0.008	0.004	0.030	0.005	0.000	0.000	0.000	0.017	0.108	0.005

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STORET ID		Cong. 158 (ng/L)	Cong. 16+32 (ng/L)	Cong. 163+138 (ng/L)	Cong. 167 (ng/L)	Cong. 170+190 (ng/L)	Cong. 172 (ng/L)	Cong. 174 (ng/L)	Cong. 177 (ng/L)	Cong. 178 (ng/L)	Cong. 18 (ng/L)	Cong. 180 (ng/L)	Cong. 183 (ng/L)	Cong. 185 (ng/L)
170141	Tahquamenon River													
	9/12/2000	0.000	0.024	0.005	0.000	0.001	0.000	0.000	0.001	0.000	0.018	0.000	0.000	0.000
040123	Thunder Bay River													
	8/2/2000	0.000	0.037	0.024	0.000	0.000	0.000	0.002	0.002	0.000	0.029	0.002	0.001	0.000
730025	Tittabawassee River													
	8/14/2000	0.004	0.061	0.028	0.000	0.003	0.000	0.005	0.005	0.000	0.060	0.006	0.004	0.000

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STORET ID		Cong. 187+182 (ng/L)	Cong. 19 (ng/L)	Cong. 193 (ng/L)	Cong. 194 (ng/L)	Cong. 198 (ng/L)	Cong. 199 (ng/L)	Cong. 201 (ng/L)	Cong. 202+171 (ng/L)	Cong. 203+196 (ng/L)	Cong. 206 (ng/L)	Cong. 207 (ng/L)	Cong. 208+195 (ng/L)	Cong. 22 (ng/L)
170141	Tahquamenon River													
	9/12/2000	0.001	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008
040123	Thunder Bay River													
	8/2/2000	0.001	0.004	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013
730025	Tittabawassee River													
	8/14/2000	0.002	0.000	0.000	0.002	0.000	0.000	0.007	0.002	0.000	0.002	0.000	0.004	0.041

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